

Special features
 Jumping off point
 Factor 42x
 Structure of microfiche
 Troubleshooting
 Test chart for
 universal test adapter
 Vehicle-specific
 instructions,
 divided into
 working steps,
 complete (no cross
 references)

Test values
 General information
 (tools, electrical terminal
 diagram)
 installation position of
 components.

BOSCH
 H.H.E. 1985
 Fahrzeug/Motor, Erzeugnis
 S.S.
 K.H.V.D.
 K.X.X.I.A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24


Valid Technical Bulletins and
 Service Information

Table of contents/Impressum

- | | |
|------------|-----------------------------|
| E16 | Product/component/test step |
| | Vehicle/engine |

↑ Coordinate

- 



One-page section

- C6**

A1

Trouble-shooting program



This microcard contains the trouble-shooting instructions for the Motronic in the following BMW models valid at press date:

BMW 535i, 635 CSii, 735i (10.84 →)

SPECIAL FEATURES

- Adaptive lambda closed-loop control

Operation:

The adaptive lambda closed-loop control has basically the same function as the standard lambda closed-loop control, with the difference that initial open-loop control (basic setting of fuel induction) is continuously revised ($\lambda = 1$) in order to adapt to deviations which occur in the course of a vehicle's operating life. Such deviations can, for example, be occasioned by the following factors:

- Fluctuations in air density
- Leakage air
- Changes in density and quality of fuel
- Deposits on valves and in combustion chamber.

Note:

The correction values for adaptation are entered in the control unit memory. The control unit is constantly supplied with battery voltage (permanent positive, term. 18).

If the battery or control unit are disconnected, the correction values are lost, so that faults can initially appear which were previously compensated for by the system's adaptive ability (e.g. leakage air). These faults must be rectified for the basic setting of the engine.

It is recommended to then take a test drive in order to make possible the fine adjustment of the adaptive initial open-loop control.



1. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the Motronic specialist to rapidly check the electrical components of the system using the universal test adapter.

- * In vehicles with electronic transmission control there is a functional connection to the Motronic system. Trouble-shooting must therefore be continued in transmission control, if no fault was detected in the Motronic.
- * If no adapter lead 1 684 463 128 is available, the adapter lead .. 124 can be used instead; however, the "lambda test steps" must then be additionally checked.



Rapid Diagnosis Chart for Universal Test Adapter; control unit 0 261 200 059

Test Step	Switch Position		Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω			
1	↓	1	Disengage gear, ignition off. Unplug Motronic control unit and pump relay. Likewise unplug transmission control unit (if electronic transmission control present). Check insulation resistance of engine-speed sensor term. 8 to term. 5.	greater than 1 M Ω	C18
2	↓	2	Measure insulation resistance of reference-mark sensor term. 25 to term. 5.	greater than 1 M Ω	C22
3	↓	3	Measure winding resistance of engine-speed sensor term. 8 to term. 27	0.6 ... 1.6 Ω	D 3
4	↓	4	Measure winding resistance of reference-mark sensor term. 25 to term. 26.	0.6 ... 1.6 Ω	D 7
5	↓	5	Measure resistance of engine temperature sensor (NTC II) term. 13 to term. 5.	at +15°C to +30°C: 1.3 ... 3.6 k Ω (temperature-dependent)	D11
6	↓	6	Measure resistance of air temperature sensor (NTC I) term. 22 to term. 5.	at +15°C...+30°C: 1.45...3.5 k Ω (temperature-dependent)	" D13
7	↓	7	Measure resistance of characteristic-map switch term. 10 to term. 5.	Manual transmission: less than 10 Ω Automatic: greater than 1 M Ω	D15
8		8	Not applicable	---	---
9	↓	9	Accelerator pedal in rest position. Measure resistance of idle contact term. 2 to term. 5. Operate accelerator pedal (part-load range)	less than 10 Ω $\infty \Omega$	D17

A4

Rapid diagnosis chart

BMW



A5

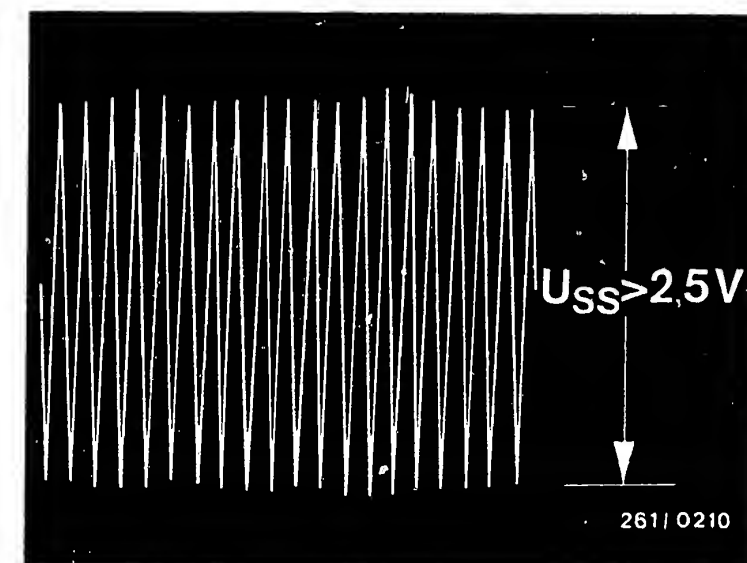
Rapid diagnosis chart

BMW



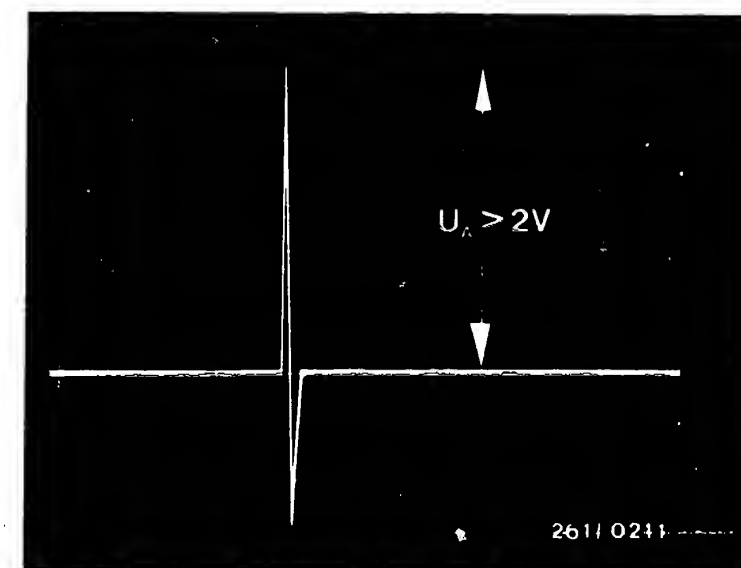
Rapid Diagnosis Chart for Universal Test Adapter (continued)

Test Step	Switch Position		Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω			
10	↓	10	Fully depress accelerator pedal (full-load stop). Measure resistance of full-load contact term. 3 to term. 5. Caution with vehicles having electronic transmission control! No full-load contact; instead full-load enrichment via transmission control unit term. 31. Testing in test step 42.	less than 10 Ω	D 21
11	↓	11	Measure resistance. Ground term. 16 to term. 5	less than 10 Ω	D 23
12	↓	12	Measure resistance. Ground term. 17 to term. 5	less than 10 Ω	E 1
13	↓	13	Measure resistance. Ground term. 19 to term. 5	less than 10 Ω	E 3
14	↓	14	Not applicable	---	--
15	↓	15	Not applicable	---	--
16	1	15	Test engine-speed sensor signal with oscilloscope. Term. 8 to term. 27. Disengage gear and start.	See upper illustration	E 5
17	2	15	Test reference-mark sensor signal with oscilloscope, term. 25 to term. 26. Disengage gear and start.	See lower illustration	E 9



Engine-speed sensor signal

Reference-mark sensor signal.
Positive peak must come first.



A6

Rapid diagnosis chart
BMW



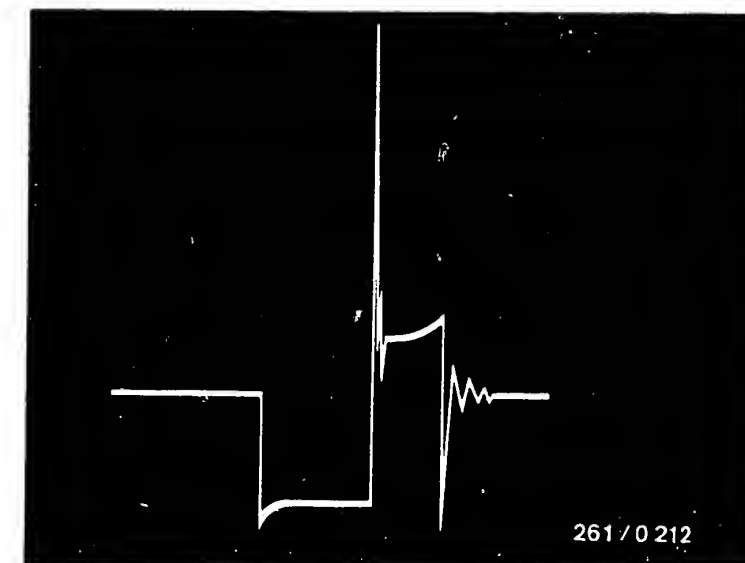
A7

Rapid diagnosis chart
BMW



Rapid Diagnosis Chart for Universal Test Adapter (continued) control unit 0 261 200 059

Test Step	Switch Position		Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω			
18	3	15	Not applicable	---	--
19	4	15	Connect control unit and switch on a/c (if present). Measure voltage at term. 29 to term. 25. Ignition on.	greater than 8 V	E 13
20	6	15	Measure voltage at relay 2 (main relay) term. 35 to term. 5	10 ... 15 V	E 15
21	7	15	Measure voltage supply at term. 18 to term. 5 with ignition off (permanent positive).	10 ... 15 V	E 17
22	5	15	Test ignition signal with oscilloscope. Disengage gear and start. Control unit, ignition output stage term. 1 to term. 5.	See Illustration	E 19



Ignition signal (primary signal)

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Rapid diagnosis chart

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A9

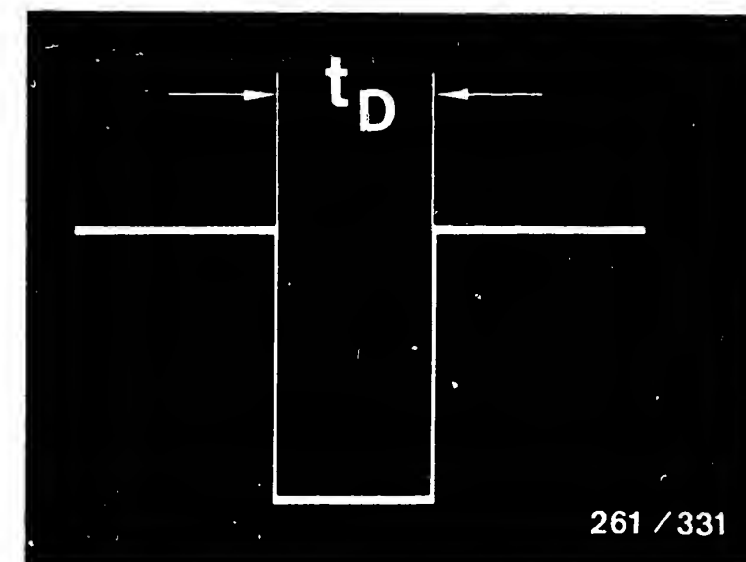
Rapid diagnosis chart

BMW



Rapid Diagnosis Chart for Universal Test Adapter (continued) control units 0 261 200 059

Test Step	Switch Position		Key	Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω				
23	8	15		Measure voltage at control unit term. 9 to term. 5.	<u>greater than 4.5 V</u>	E 21
24	9	15		Measure voltage at air-flow sensor term. 7 to term. 5. Sensor flap in rest position: Sensor flap fully opened:	<u>200...300 mV</u> <u>greater than 4.2 V</u>	E 23
25	10	15		Not applicable	---	--
26	11	15		Measure voltage. Term. 28 to term. 5. Ignition on	Manual trans.: <u>approx. 0 V</u> Automatic trans.: Positions N,P: <u>approx. 0V</u> Positions 1, 2, 3, D, R,: <u>greater than 3.5 V</u>	F 1
27	12	15		Voltmeter starting signal term. 50 term. 4 to term. 5 Disengage gear and start	<u>8 ... 15 V</u>	F 3
28	13	15		Check control unit dwell-period signal with oscilloscope. Term. 21 to term 5. Disengage gear and start.	<u>See illustration</u>	F 5



Dwell-period signal
 t_D = Dwell period

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Rapid diagnosis chart

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A11

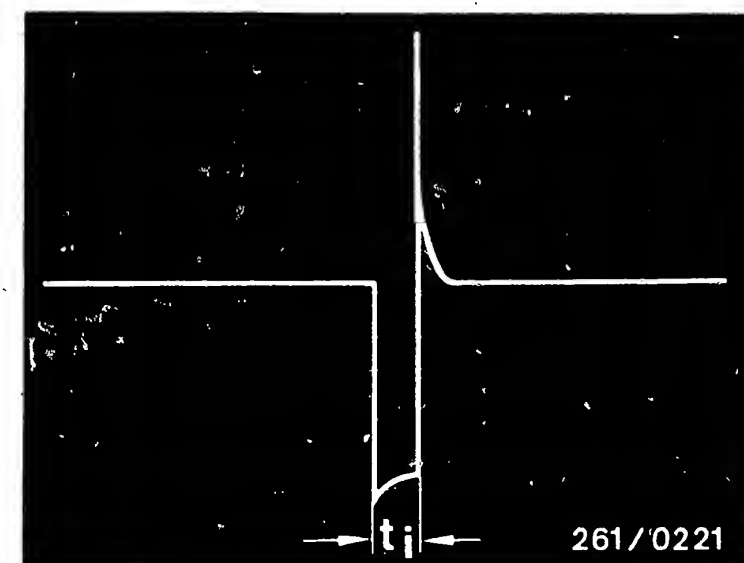
Rapid diagnosis chart

BMW



Rapid Diagnosis Chart for Universal Test Adapter (continued)

Test Step	Switch Position		Key	Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω				
29	14	15		Test injection signal from control unit with oscilloscope term. 14 to term. 5. Disengage gear and start	See Illustration	F 7
30	14	15	T1	As 29, but after pressing key (NTC II, cold) injection time becomes slightly longer. (Engine speed increases)		F 9
31	15	15		As test step 29, however test term. 15 to term. 5.		F 11
32	16	15		Test injection signal from control unit with oscilloscope term. 11 to term. 5. Disengage gear and start.		F 13
33	17	15		Plug in pump relay. Measure voltage at pump relay term. 20 to term. 5. Ignition on.		F 15
					10...15 V	



Ignition signal.
 t_i = Duration of ignition

A12

Rapid diagnosis chart
 BMW



A13

Rapid diagnosis chart
 BMW



Rapid Diagnosis Chart for Universal Test Adapter (continued)

Test Step	Switch Position		Key	Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω				
34	17	15		Measure voltage. Disengage gear and start. Control unit, pump control active. Term. 20 to term. 5.	max. 4 V	F 17
35	17	15	T3	Ignition off. Connect pressure gauge. Ignition on. Press key T3, read fuel pressure.	2.8 ... 3.2 bar	F 19
36	17	15		Check idle speed and CO (before cat. converter). Engine at operating temperature, switch off electrical devices, including diagnosis lead and motortester. For exhaust gas basic setting, briefly interrupt voltage supply of control unit. Using adapter lead 1 684 463 124, separate plug connection of lambda sensor (open-loop control).	750...850 min ⁻¹ 0.2...1.2 Vol.%CO	G 1
	17	15	T2	Values unchanged, as above		
37	17	15		Let engine run. Check ignition timing at idle speed. Important! Idle speed must be between 750 and 850 min ⁻¹ , otherwise other ignition timings are shown! If idle speed fluctuates, ignition timing fluctuates as well.	At idle speed: 8° ... 18°	G 5
	17	15	T6	Check ignition timing at full load. Set idle speed to 2500 min ⁻¹ and press key T6 (full-load key). <u>Careful!</u> With vehicles with electronic transmission control, disconnect transmission control unit or separate 13-pin plug in area of glove compartment before pressing T6 key (otherwise, danger of destruction of transmission control unit).	Intake-air temperature less than 23°...33° greater than 45°C: 14°...24°	
38	17	15		Dwell angle at idle speed	6° ... 18°	G 7
				Dwell angle at 2000 min ⁻¹	15°...35°	
39	17	15	T5	Keep engine speed at constant 2000 min ⁻¹ . Press key T5. Injection signals go out and go back on at approx. 1000 ... 1200 min ⁻¹ (engine at operating temperature).	Engine "surges"	G 9

A14

Rapid diagnosis chart

BMW



A15

Rapid diagnosis chart

BMW



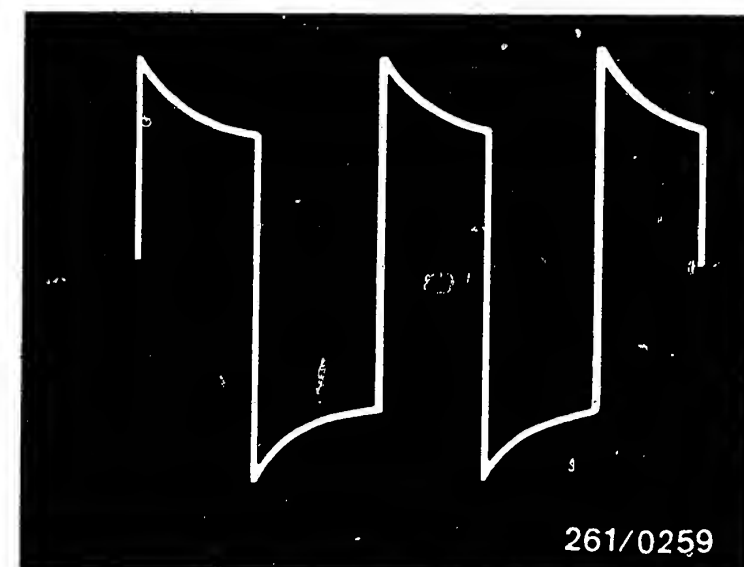
Rapid Diagnosis Chart for Universal Test Adapter (continued)

Test Step	Switch Position		Key	Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω				
40	18	15	T5 and T6	Check on-off ratio of idle-mixture control. Term. 33 to term. 5 with dwell-angle tester (% scale). Clip 15 of motor tester to red well. Transmission control unit (if present) unplugged, 13-pin plug removed. When keys T5, T6 are pressed, engine speed should go back to 750...800 min ⁻¹ (if necessary, correct and reset throttle-valve switch). Read on-off ratio.	51 % ... 61 % See upper illustration for signal form (oscilloscope, special input)	G 11
41	19	15	T5 and T6	As test step 40, except term. 34 to term. 5.	39% ... 49% (Signal form - see upper illustration)	G 13
42		10		Test step applies only to vehicles with electronic transmission control. Careful! Voltage measurement at ohm sockets. Switch multimeter to voltage measurement. Connect transmission control unit, disconnect pump relay. Position switch in position P. Do not depress accelerator pedal.	1. After short starting do not turn off ignition: <u>greater than 2 V</u> 2. Give full throttle: <u>less than 1 V</u>	G 15

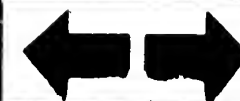
Testing of lambda closed-loop control can be carried out as follows:

1. With adapter lead 1 684 463 128: test steps 43, 44, 45
2. Without test adapter, if only adapter lead 1 684 463 124 is available for testing Motronic: test steps 43a, 44a, 45a.

With both test methods, connect CO tester before catalytic converter and operate engine at operating temperature in idle.



Signals at idle actuator



Rapid Diagnosis Chart for Universal Test Adapter (continued)

Test Step	Switch Position		Remarks	Test Specifications (Reading)	Trouble-Shooting See Coordinates
	V	Ω			
43	20	22	Testing with adapter lead 1 684 463 128: Check lambda closed-loop control upper limit. Test adapter connect term. 24 of control unit to ground. (For the sake of the catalytic converter, carry out this test step for a short period only).	<u>CO rises above 1.2 vol. %</u>	G 18
44	20	23	As test step 43, except check lambda closed-loop control lower limit. Test adapter connects term. 24 of control unit to +2 V.	<u>CO falls below 0.2 vol. %</u> Uneven engine idle	G 20
45	20	24	As test step 43, except test closed-loop operation (lambda sensor). Test adapter connects term. 24 of control unit with lambda sensor. Pull air hose from fuel-pressure regulator and seal off.	<u>CO= 0.2...1.2 vol.%</u> CO rises for short period and falls back to above control value.	G 22
43a	--	--	Testing lambda closed-loop control without test adapter: Lambda closed-loop control upper limit is tested (control unit). Separate plug connection from lambda sensor and connect lead to control unit (term. 24) to ground. For sake of catalytic converter, carry out this test step for short period only.	<u>CO rises above 1.2 vol. %</u>	G 24
44a	--	--	Testing lambda closed-loop control lower limit (control unit). Connect separated lead to control unit (term. 24) to approx. +2 Voltage (e.g., use 1.5 V single-cell battery, positive to term. 24 and negative to vehicle ground).	<u>CO falls below 0.2 vol. %</u> Uneven engine idle	G 24
45a	--	--	Testing lambda sensor enclosed-loop operation. Reconnect plug connection from lambda sensor. Pull air hose from fuel-pressure regulator and seal off.	<u>CO= 0.2...1.2 vol.%</u> CO rises for short time and falls back to above control value.	G 24



2. TEST SPECIFICATIONS

Idle speed

750 ... 850 min⁻¹

K1

Exhaust setting

CO value with engine at
operating temperature:
(before cat. converter)

0.2...1.2 vol. % CO

Fuel pressure

2.8 ... 3.2 bar

M9

Fuel pump delivery quantity:

min. 950 cm³/30s

Pre-supply pump:

approx. 1050 cm³/30 s

For settings for ignition, valve play, and other
technical engine data, see equipment and Autodata
microcard.

L1

Solenoid-operated injection valve

Electrical internal
resistance

15 ... 17.5 Ω

H3

Air-flow sensor

Resistance between

term. 7 and term. 6:

8 Ω ... 2500 Ω

(Deflect sensor flap
from rest position to
full-load stop)

Term. 9 and term. 6:

500 Ω ... 1100 Ω

Idle actuator

Electrical internal resistance
at + 15°C...+30°C between

Term. 1 and term. 2:

19 ... 25 Ω

Term. 3 and term. 2:

17 ... 22.5 Ω

Lambda sensor

Resistance of heating winding: 1 ... 15 Ω

(Temperature-
dependent)

A20

Test specification

BMW



Temperature sensor I (NTC I-air):

Electrical internal

resistance at +15°C...+30°C): 1.45 ... 3.3k Ω

(Measured at air-flow sensor
between term. 22 and term. 6)

At +80°C: 280 ... 360 Ω

D13

Temperature sensor II (NTC II - coolant):

Electrical internal resistance

at +15°C...+30°C: 1.3 ... 3.6k Ω

at +80°C: 250 ... 390 Ω

D11

Engine-speed sensor and reference-mark sensor

Electrical internal

resistance: 0.6 ... 1.6k Ω

D3

Throttle-valve switch

Resistance from

Idle contact (terms. 2
and 18):

0 Ω

Full-load contact (terms.
3 and 18):

0 Ω

K7

Note: With electronic transmission control no
full-load contact, instead, full-load enrichment via
transmission control unit (term. 31). Idle contact
via microswitch or at throttle-valve sensor term. 4
(term. 6 with 6-pin plug)

Thermo-time

switch

35°/8s

Electrical internal resistance:

"G" and
ground

"W" and
ground

"G" and
"W"

H17

Ambient temp.

(below +30°C): 25...40 Ω 0 Ω 25...40 Ω

Operating temp.

(above +40°C): 50...80 Ω 100...160 Ω 50...80 Ω

Start valve

H11

Electrical internal resistance approx. 4 Ω

A21

Test specifications

BMW



TEST STEP 35, Continued

When using pressure tester KDJE-P 100, the valve screw must be screwed shut.

Make certain connections do not leak!

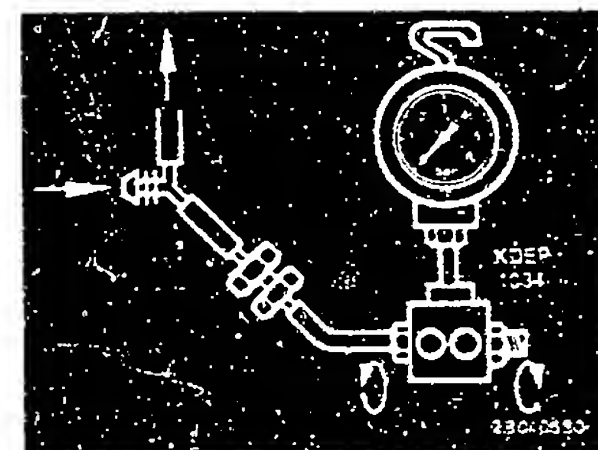
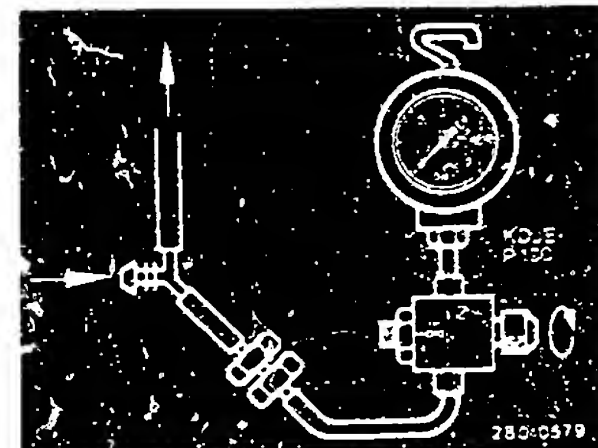
Switch ignition on. To measure pressure, press button T3.

Trouble-shooting, TEST STEP 35

1. Pressure 0 bar, no pump noises audible:

- Check pump fuse (No. 11 in the fuse box).
- Take out and replace relay 1 (pump relay) (6).

Continued on F23/F24



F21

Testing with the universal test adapter

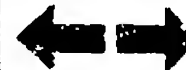
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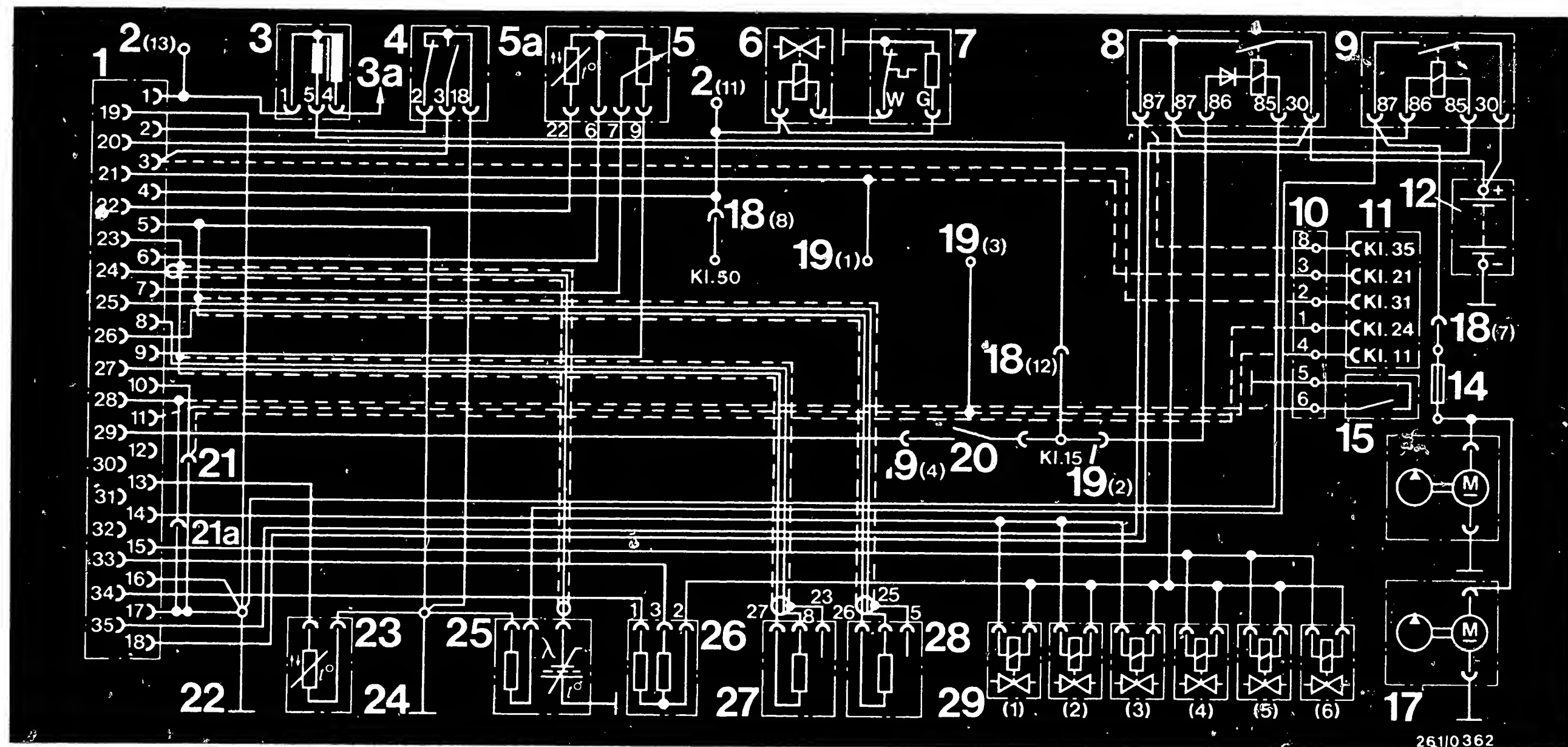


F22

Testing with the universal test adapter

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3. ELECTRICAL TERMINAL DIAGRAM

- 1 = Motronic control-unit plug
- 2 = Diagnosis plug (No. 13)
- 3 = Ignition coil
- 3a = To high-voltage distributor
- 4 = Throttle-valve switch (no full-load contact with electronic transmission control)
- 5 = Air-flow sensor

- 5a = Temperature sensor I (air)
- 6 = Start valve
- 7 = Thermo-time switch
- 8 = Relay 2 (main relay with reversed-polarity protection diode)
- 9 = Relay 1 (pump relay)
- 10 = Plug connection (13-pin) in glove compartment (with electronic transmission control)

- 11 = Control unit for electronic transmission control (where present)
- 12 = Battery
- 14 = Pump fuse
- 15 = Driving position switch with automatic trans. and electronic transmission control: in pos. P and N, to ground; in pos. D, 1, 2, 3, R, open

B1

Electrical terminal diagrams

BMW

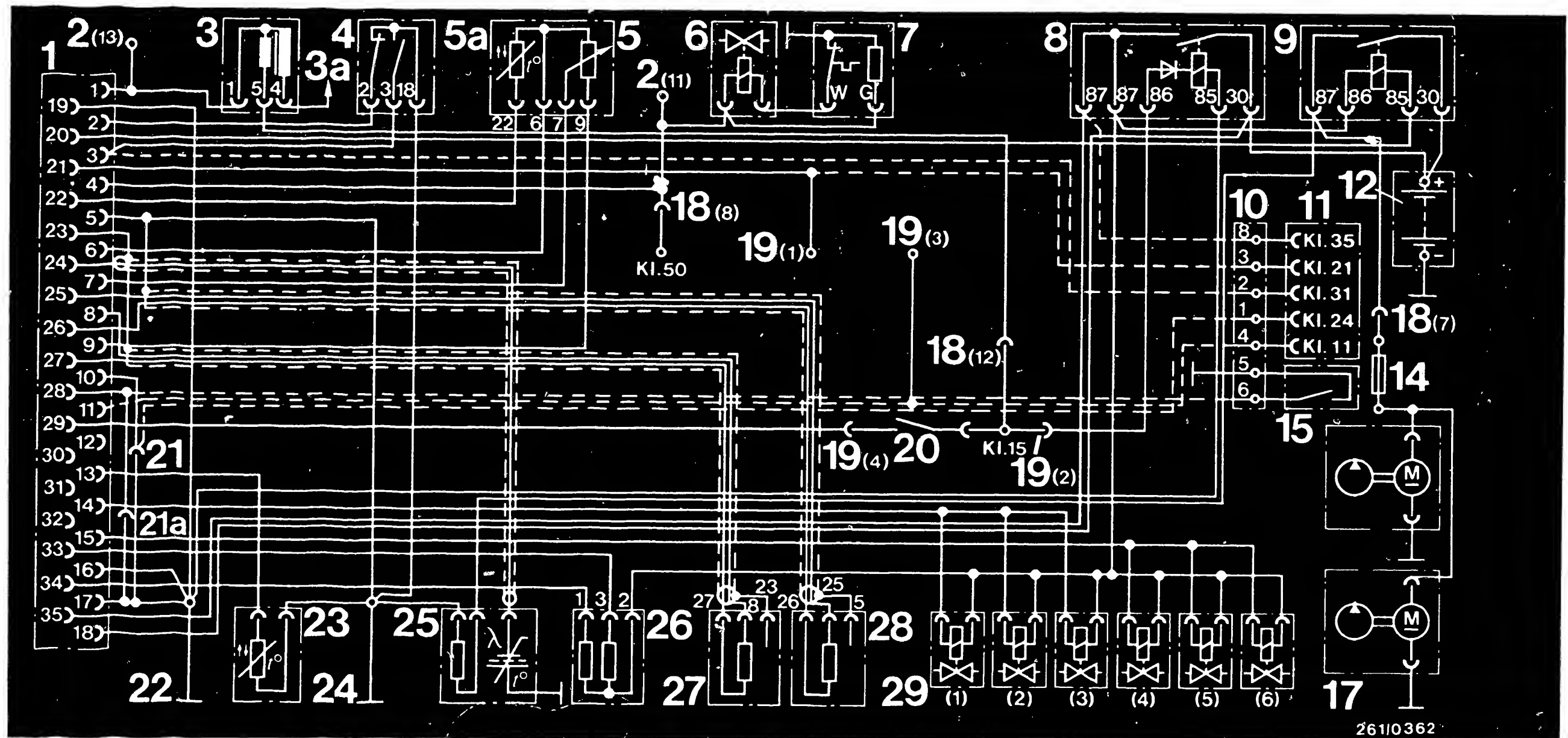


B2

Electrical terminal diagrams

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Electrical Terminal Diagram (Continued)

- 17 = Fuel and pre-supply pump
- 18 = Engine plug (no. 7, 8, 12)
- 19 = Plug connection (3- or 4- pin,
no. 1, 2, 3, 4, in glove compartment)
- 20 = A/C switch
- 21+ = Plug connection(s) connected with
manual transmission (with automatic
transmission, open or not present)

- 22 = Vehicle ground for control unit
output stage
- 23 = Temperature sensor (coolant)
- 24 = Vehicle ground for control unit
- 25 = Lambda sensor (heated)
- 26 = Idle actuator
- 27 = Engine-speed sensor
- 28 = Reference-mark sensor
- 29 = Injection valves

B3

Electrical terminal diagram

BMW

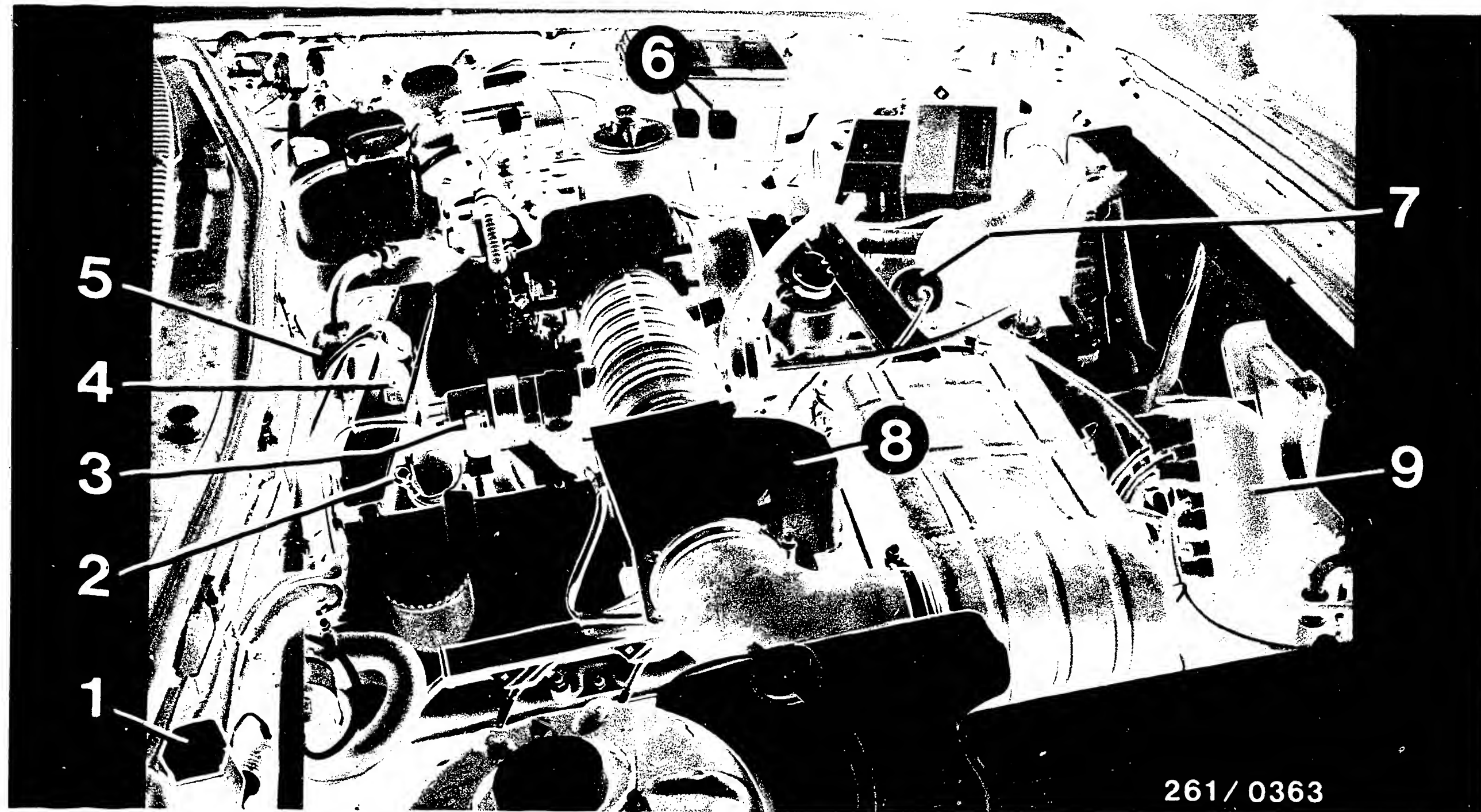


B4

Electrical terminal diagram

BMW





261 / 0363

4. INSTALLATION POSITION OF COMPONENTS

- 1 = Main relay (735i)
- 2 = Central ground
- 3 = Idle actuator
- 4 = Plug-in connections for engine-speed and reference-mark sensors

- 5 = Fuel-line-pressure damper in fuel line (fuel-line-pressure damper in return line near pressure regulator)

- 6 = Main and pump relay (535i and 635 CSi)
- 7 = Pressure regulator
- 8 = Air-flow sensor
- 9 = High-voltage distributor

Note: The arrangement of relays on the electrics box does not always correspond to the illustrations.

B5

Installation position of components

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B6

Installation position of components

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Installation Position of Components (continued)

Installation information is always relative to direction of travel. The following lists components which are not visible in the illustration.

- Reference-mark and engine-speed sensor:

In starting-motor ring gear housing on the circumference of the flywheel ring gear.

- Fuel filter, fuel spinner, fuel pump:

Underneath vehicle on the left, near fuel tank.

- Electric fuel pump ground lead:

Underneath rear seat, to the left (well), ground point on body.

- Motronic control unit:

In glove compartment behind panel or in A-post to the right behind loud speaker cover.

- Transmission control unit:

(only vehicles with electronic transmission control)

In the A-post to the right or left behind loudspeaker cover.

- Temperature sensor I (air):

In air-flow sensor

- Temperature sensor II (engine):

In front intake manifold, near fan.

- Central ground:

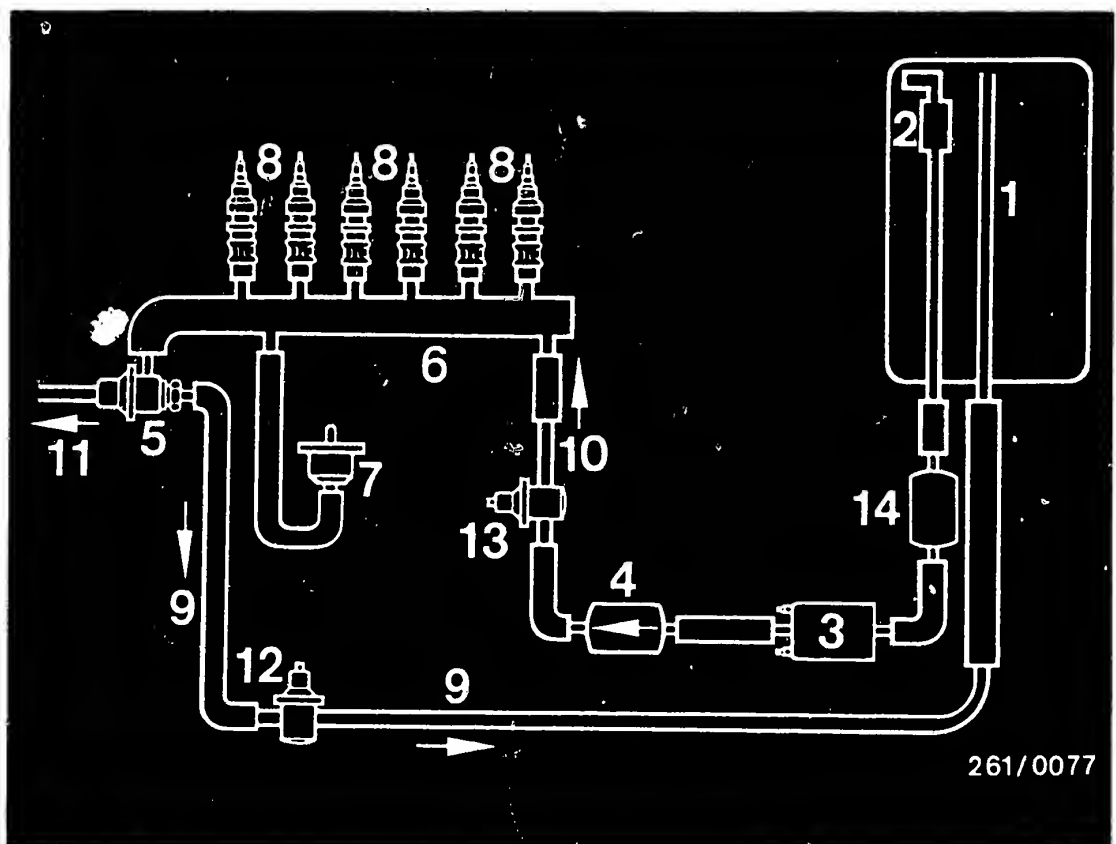
On intake manifold between 5th and 6th cylinders.

- CO connection:

2 connections in exhaust manifold:

One exhaust screw plug each for cylinders 1, 2, 3 and 4, 5, 6.





5. FUEL LINE DIAGRAM

- 1 = Fuel tank
 - 2 = Fuel pre-supply pump (in the tank)
 - 3 = Electric fuel pump
 - 4 = Fuel filter
 - 5 = Pressure regulator
 - 6 = Fuel distribution pipe
 - 7 = Start valve
 - 8 = Solenoid-operated fuel-injection valve
 - 9 = Fuel return line
 - 10 = Fuel delivery line
- Fuel delivery and return lines run on the underside of the vehicle, on the left.
- 11 = To the intake manifold
 - 12 = 1st fuel-line-pressure damper
 - 13 = 2nd fuel-line-pressure damper
 - 14 = Fuel spinner

6. TEST EQUIPMENT AND TOOLS

<u>Name</u>	<u>Designation</u>	<u>Part No.</u>
Universal test adapter Adapter lead USA/Japan Adapter lead	ETT 018.01	0 684 101 801 1 684 463 128 1 684 463 124*
Motortester	e.g. MOT 201	0 684 000 201
Diagnosis cable for measurement of timing angle		1 684 463 122
Exhaust gas tester	e.g. ETT 008.02 or ETT 008.03	0 684 100 802 0 684 100 803
Multimeter (min. internal resistance 20 k Ω /V)		commercially available e.g., Metra- watt GmbH Type MA2H or Fluke Multi- meter 75 or 77
Pressure gauge 6 bar or pressure tester or pressure tester (no longer available) Three-way line as connection for KDJE-P 100 and KDEP 1034	Quality class 1.0 Graduation 0.1 bar	1 687 231 154 KDJE-P 100 KDEP 1034 KDJE-P 100/13

* As replacement for adapter lead 1 684 463 128.



<u>Name</u>	<u>Part Number</u>
Feeler gauge for measuring the sensor air gaps (up to 1 mm)	commercially available
Lubricant for rotational-speed and reference mark sensors	Molykote Longterm 2 commercially available
Chassis dynamometer, e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pole, for measuring resistances and signals, e.g., on fuel-inject- ion valves	1 684 463 093
Test leads for proper connection of test equip- ment to component plugs	KDZS 0004 (2.8 mm wide) KDZS 0005 (6.3 mm wide)
BMW exhaust-gas probe/adapter: BMW no. 130 090 / 130 100	
<u>For USA/Japan:</u> Tool kit for removing and putting on the idle-CO anti- tamper device for the air-flow sensor, e.g., No. 13 1090 from Cartool Hans Schubert KG Unterer Grasweg 88 D - 8070 Ingolstadt or from BMW of America	
Mounting paste VS 14016 Ft for the lambda sensor and the exhaust gas screw plug	5 960 080 105
Clamp to crimp off fuel and air hoses	commercially available

B 10

Test equipment and tools

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7. IMPORTANT GENERAL INSTRUCTIONS

Be absolutely certain to follow instructions in order to avoid damage to the engine, the control unit, or the ignition coil and to prevent endangering human life.

- Never start the engine unless the battery is firmly connected.
- Incorrect polarity of supply voltage, e.g. through incorrect connection of battery or ignition coil, can lead to the destruction of the control unit.
- Do not use a quick charger to start the engine.

Provide starting assistance only with a second 12 V battery and a starting assistance cable.

Caution!

Due to differing requirements from vehicle manufacturers for electronic products, we recommend not using any batteries with 24 V for starting assistance. Follow the operating instructions for the vehicle.

- Separate the battery from the vehicle electrical system before quick charging.
- When charging the battery in the vehicle, or during starting assistance, follow instructions in the operator's handbook for the quick-charger and instructions from the vehicle manufacturer.
- Never disconnect the battery from the vehicle electrical system with the engine running.
- Do not short-circuit ignition coil Term. 1 to ground (e.g., to shut off the engine). The ignition coil and under some circumstances the control unit are destroyed.



8. TROUBLE SHOOTING

The purpose of the trouble-shooting programs below is to make it possible, when used in conjunction with the universal test adapter and other suitable test equipment, for the workshop employees to identify quickly the causes of defects on the Motronic. A selection can be made between the job procedures below, depending on the training and the experience of the mechanic.

- Detailed, step-by-step trouble-shooting
for employees with little experience and practice on vehicles with the Motronic
- Targeted trouble-shooting, leading directly to the cause of the defect
for trained and experienced employees with a fairly large amount of practice on vehicles with the Motronic.

C3

C5

Both trouble-shooting programs start with checking the electrical/electronic portion of the Motronic using the universal test adapter ETT 018.01. With this, the electrical function of the wiring harness and the components connected to it (including the control unit) are checked quickly and defects are quickly identified.

If no defect is found using the universal test adapter, it is necessary to continue with the detailed or the targeted trouble-shooting.

C1

Trouble-shooting

BMW



C2

Trouble-shooting

BMW



8.1 Detailed, step-by-step trouble-shooting

8.1.1 Test with universal test adapter

This test must come at the beginning of the testing program and must be performed from beginning to end.

8.1.2 Trouble-shooting according to customer complaints (fault symptoms)

The table below contains possible fault symptoms and the column on the right gives the first coordinate of the respective detailed trouble-shooting program.

The trouble-shooting program consists of logically ordered test procedures for all Motronic components.

If, after completing the trouble-shooting program for an assumed symptom, the fault has not been detected or remedied, choose a new fault symptom and work through another program.

<u>Customer complaints (fault symptoms)</u>	<u>Test with universal test adapter</u>	<u>Coordinates</u>
1. Starting motor operates, engine fails to start or starts only with difficulty	C 11	H 1
2. Engine starts but then dies	C 11	H 23
3. Rough idle/incorrect idle speed	C 11	J 11
4. Poor throttle take-up	C 11	K 3
5. Engine missing under all operating conditions	C 11	K 19
6. Fuel consumption too high	C 11	L 9
7. Maximum engine power/top speed not reached	C 11	L 21
8. CO concentration at idle too high or too low	C 11	M 15

C3Trouble-shooting
BMW**C4**Trouble-shooting
BMW

8.2 Pin-pointed, direct trouble-shooting

8.2.1 Test with universal test adapter

The test with the universal test adapter must come at the beginning of the testing program and must be performed from beginning to end.

8.2.2 Trouble-shooting according to customer complaints

The table below contains various fault symptoms with several possible causes of the trouble in each case. The coordinate reference panel indicates the first coordinate of the testing procedure for the respective Motronic component.

If, after testing the individual components, the fault has not been detected or remedied, choose a new fault symptom.

Customer complaints (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty								
2. Engine starts but then dies								
3. Rough idle/incorrect idle speed								
4. Poor throttle take-up								
5. Engine missing under all operating conditions								
6. Fuel consumption too high								
7. Maximum engine power/top speed not reached								
8. CO concentration at idle too high or too low								
<u>Cause</u> (component fault)								
C11	C11	C11	C11	C11	C11	C11	C11	Test with universal test adapter
●*)								Main or pump relay defective
●*)								Electric fuel pump not operating
H9	J3	J17	K17					Idle speed control defective
		●*)				●*)		Throttle-valve switch (idle and full-load contacts) defective
H19	J9	J15	K9	K23	L15	M1	M17	Air-flow sensor defective

Continued on C7/C8, C9/C10

C5

Trouble-shooting

BMW



C6

Trouble-shooting

BMW



Customer complaints (fault symptoms)

								1. Starting motor operates, engine fails to start or starts only with difficulty
								2. Engine starts but then dies
								3. Rough idle/incorrect idle speed
								4. Poor throttle take-up
								5. Engine missing under all operating conditions
								6. Fuel consumption too high
								7. Maximum engine power/top speed not reached
								8. CO concentration at idle too high or too low
								Cause (component fault)
H19	J1	J15	K11			M13	M21	Air-intake system leaking
H3		J21	K11		L15	M3		Solenoid-operated injection valves defective
●*)		●*)				M9		Fuel pressure too low or zero, pressure regulator not operating
		●*)			●*)		●*)	Fuel pressure too high, pressure regulator not operating
				L1		M7		Insufficient fuel delivery
	●*)				●*)		●*)	Temperature sensor I (air) or temperature sensor II (coolant) defective
						L23		Throttle valve not opening fully
				K21				Poor central ground, loose contacts, faulty plug-in connection
H19	J1	J15	K11			M13	M21	Open circuit in wiring harness and plug-in connections
H11								Start valve not opening
	J5	J19			L13		M19	Start valve not closing
H17	J7							Thermo-time switch defective
		K1			L19		M23	CO exhaust-gas setting too rich
		K1	●*)				M23	CO exhaust-gas setting too lean

Continued on C9/C10

C7

Trouble-shooting

BMW



C8

Trouble-shooting

BMW



Customer complaints (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty
 2. Engine starts but then dies
 3. Rough idle/incorrect idle speed
 4. Poor throttle take-up
 5. Engine missing under all operating conditions
 6. Fuel consumption too high
 7. Maximum engine power/top speed not reached
 8. CO concentration at idle too high or too low
- Cause (component fault)

●*)								Engine-speed sensor defective
●*)								Reference-mark sensor defective
				L7				Check alternator, interference-suppression devices
H3		J13	K5	K21	L11	L23	M17	Check secondary patterns
●*)	●*)	●*)	●*)	●*)	●*)	●*)	●*)	Control unit defective
		●*)					●*)	Lambda closed-loop control defective

●*) This component has already been tested if you have already performed the test with the universal test adapter. Continue testing with the next component in this column.
 If, however, you have arrived at this point by way of a component complaint or the test-specifications table, you must now test this component with the universal test adapter.
 The testing program for the universal test adapter starts on Coordinate C11 and must be performed from beginning to end.

C9

Trouble-shooting
BMW



C10

Trouble-shooting
BMW



9. TESTING WITH THE UNIVERSAL TEST ADAPTER ETT 018.01
(0 684 101 801) and the adapter lead for the Motronic
(1 684 463 128)

Connect the universal test adapter to the Motronic wiring harness. (Ignition must be off).

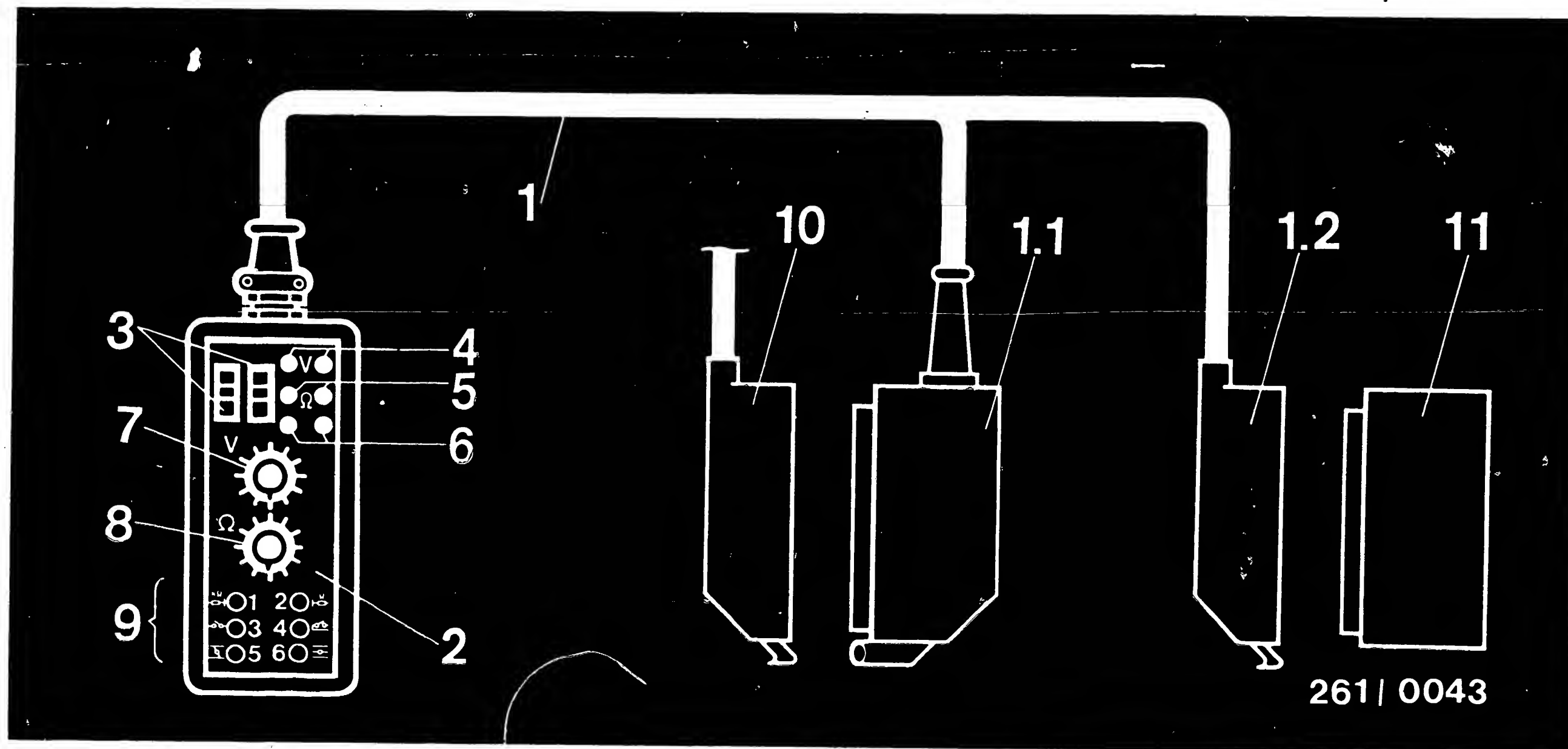
To test the wiring harness and the components connected to it, it is permissible to connect only the Motronic wiring harness, but not the control unit. Be absolutely certain to follow the instructions in the test chart.

A tester for measurement of voltage and resistance (multimeter) and a motortester are to be connected to the test adapter for taking measurements.

The individual test steps are selected using the program switch. The symbols "V" and " Ω " indicate to the operator whether voltage or resistance is being measured. Several switch settings are also required for simulation while the engine is running. By activating the buttons, with the control unit connected and the engine running, operating conditions can be changed, i.e. simulated, as desired. Thus, for example, when the engine is at normal operating temperature, an engine temperature of -20°C can be simulated for the control unit by pressing button T 1, and the reaction of the control unit can be evaluated on the motortester.

If necessary, the wiring diagram can be used for trouble-shooting.





Universal test adapter with adapter lead for Motronic

- 1 = Adapter lead
- 1.1 = Connection to the wiring harness
- 1.2 = Connection to the control unit
- 2 = Universal test adapter (Part No. 0 684 001 801)
- 3 = Test wells (for motortester)
- 4 = Test sockets (for measuring voltage)
- 5 = Test sockets (for measuring resistance)
- 6 = Test sockets (not assigned)
- 7 = Program switch "V"
- 8 = Program switch "Ω"

- 9 = Buttons to simulate operating conditions
- Button 1 = NTC II (engine), cold (-20°C)
- Button 2 = NTC II (engine), warm (+80°C)
- Button 3 = Triggering of pump
- Button 4 = Not assigned
- Button 5 = Throttle valve, idle contact
- Button 6 = Throttle valve, full-load contact
- 10 = Motronic wiring harness
- 11 = Control unit

C12

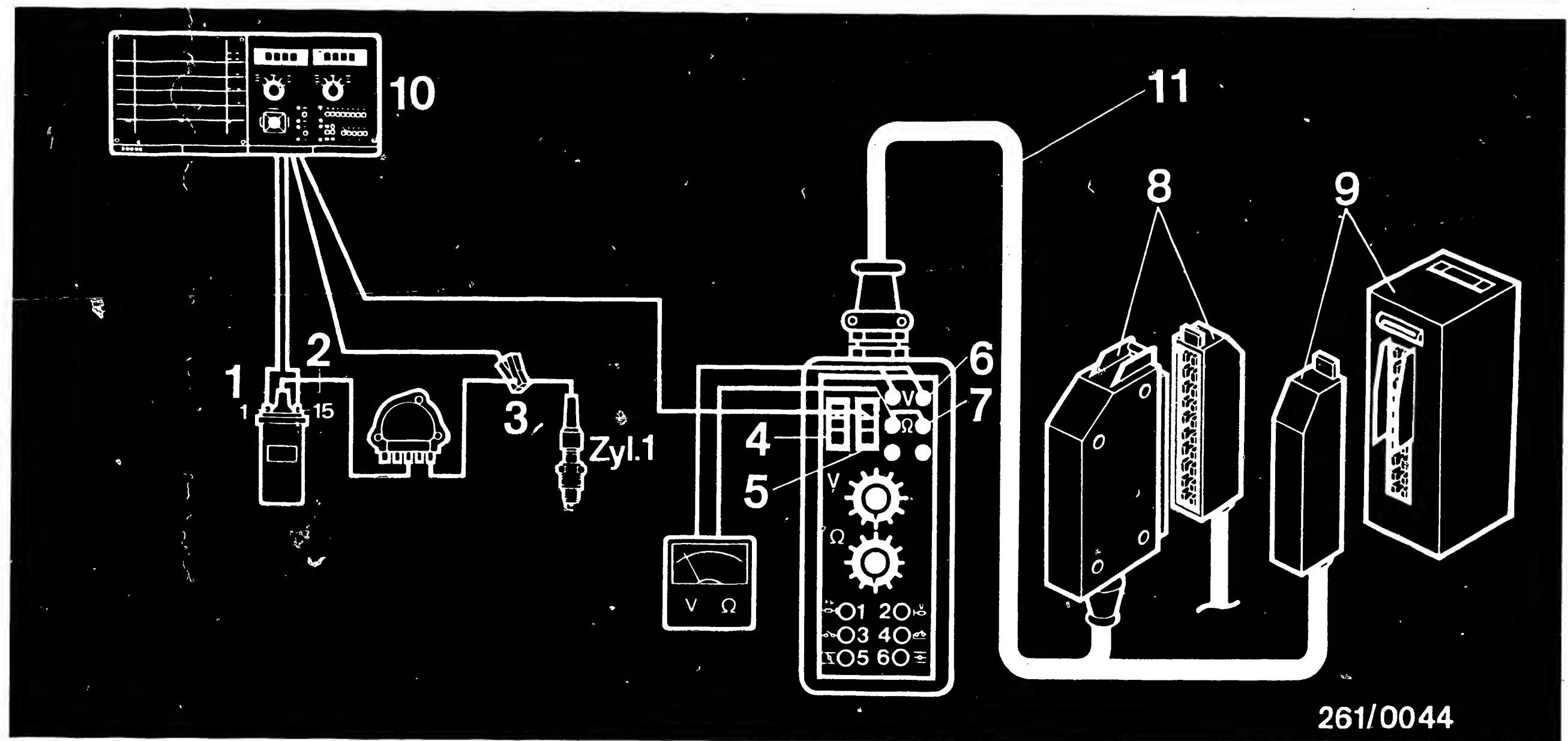
Testing with universal test adapter
BMW



C13

Testing with universal test adapter
BMW





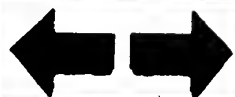
Connection diagram for universal test adapter

- 1 = Green clip to ignition coil Term. 1
- 2 = Yellow clip to ignition coil Term. 15
- 3 = Clamp-on induction pick-up over the ignition cable of cylinder 1
- 4 = Red connection socket (test well) for the red terminal of the motortester
- 5 = Black connection socket (test well) for the black terminal of the motortester

- 6 = Connection of the voltmeter to V-sockets (red = +, black = ground or -)
- 7 = Connection of the ohmmeter to Ω sockets (blue)
- 8 = Connection to the Motronic wiring harness
- 9 = Connection to the Motronic control unit
- 10 = Motortester
- 11 = Adapter lead for Motronic

C14

Testing with universal test adapter
BMW



C15

Testing with universal test adapter
BMW



Preparation for testing with the universal test adapter

Take out the control unit and connect the test adapter.

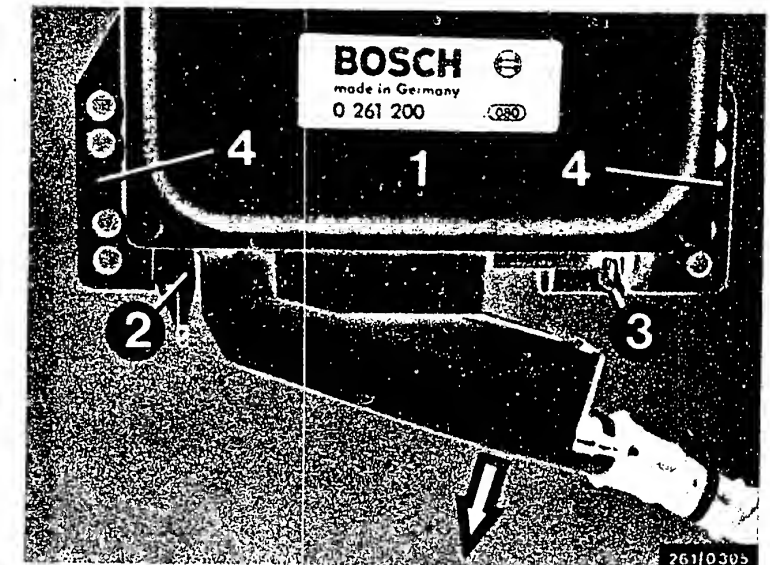
For vehicles with electronic transmission control, unplug transmission control unit.

To take it out, the detent must be pressed back and the plug must be flipped up in the direction shown by the arrow and disconnected.

The control unit is fastened with 4 screws.

Note

In order to preclude confusing the control unit for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point when connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



- 1 = Control unit for Motronic
- 2 = Fastening screws
- 3 = Control unit for idle speed control

Note:

In the test steps that follow, a white border in the column "operation" indicates what operation is to be changed from the preceding test step.

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

C16

Testing with universal test adapter
BMW

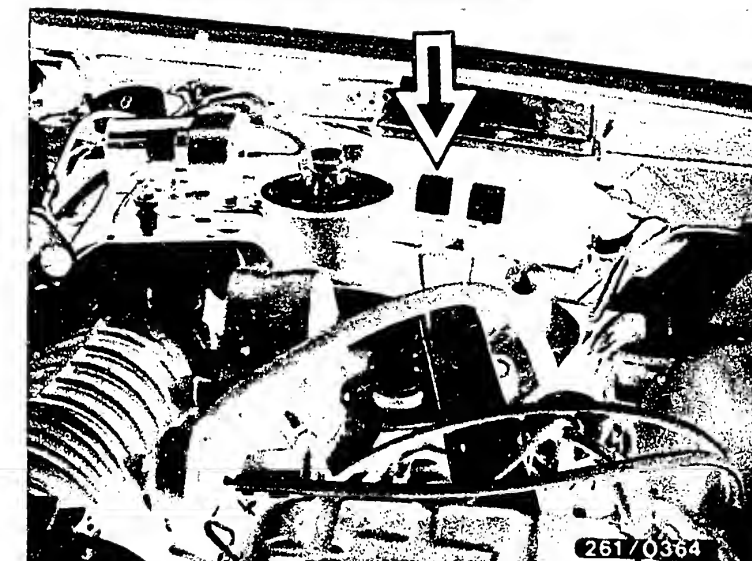


C17

Testing with universal test adapter
BMW



TEST STEP 1: Switch off ignition. Unplug motronic control unit and pump relay. Also unplug transmission control unit (if present).		Reading	Testing
Operation:			
Program switch "V" in setting:	↓	Resistance must be greater than 1 M Ω	Component: Rotational-speed sensor
Program-switch "Ω" in setting:	1		
Test equipment: Ohmmeter		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> yes ↓ Continue testing with next test step. </div> <div style="text-align: center;"> no ↓ </div> </div>	Operation: Insulation from Term. 8 to ground
Scale: 10 M Ω			Malfunction: Resistance less than 1 M Ω
Connection:			
Test sockets	Ω		
Operation in vehicle: Switch off ignition			



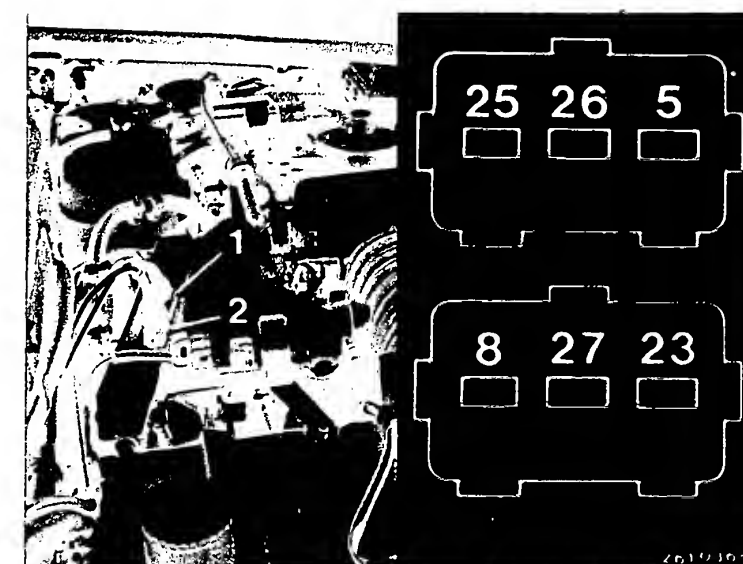
Arrow = Relay 1 (pump relay)

- 1 = Plug connection for reference mark sensor with gray plug
- 2 = Plug connection for rotational-speed sensor with black plug

Trouble-shooting:

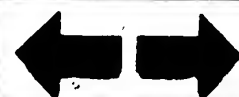
Check plug connection for corrosion and damage to insulation. Take apart the plug connection and on the plug that leads to the test adapter, jump terminals 8 and 27 with a wire. Repeat the test: If the reading is now O.K., take out and replace the rotational-speed sensor. If the reading still is less than the specified value, the leads from the control unit plug Term. 8 or Term. 27 to the plug have damaged insulation (e.g., ground connection due to wear).

Continued on C20/C21



C18

Testing with universal test adapter
BMW



C19

Testing with universal test adapter
BMW



Trouble-shooting, TEST STEP 1 (continued)

- Replace the sensor.

To take out and replace the sensors, unscrew the socket hex screw on the sensor. Remove dirt deposits on the sensor. If necessary, insert two screwdrivers into the recesses at the left and the right of the sensor and lift the sensor.

Before putting the sensor in, make certain that no metal parts cling to it. (The sensors contain permanent magnets.) Grease the sensors with Molykote Longterm 2.

Do not confuse the sensors one for the other on installation!

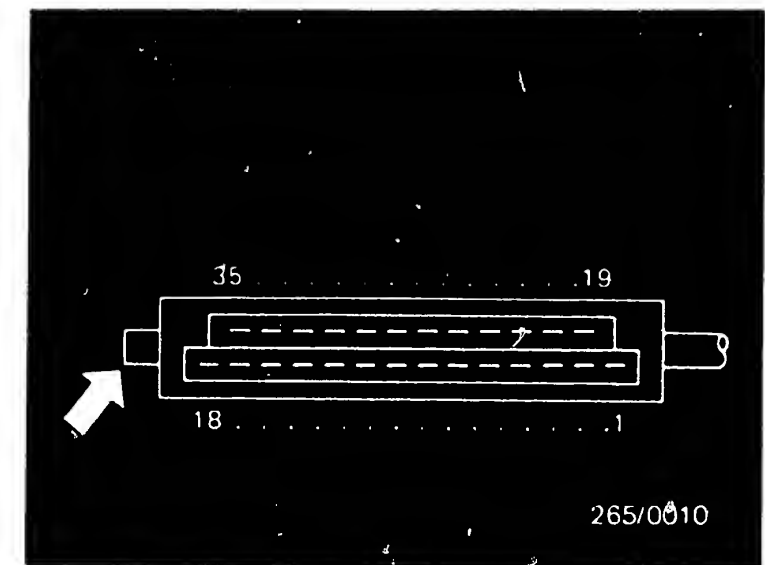
Watch the identification marking:

The reference mark sensor is identified with a cable binder.

The sensors are inserted into the hole down to the stop, and screwed tight. Do not use any force when putting them in.

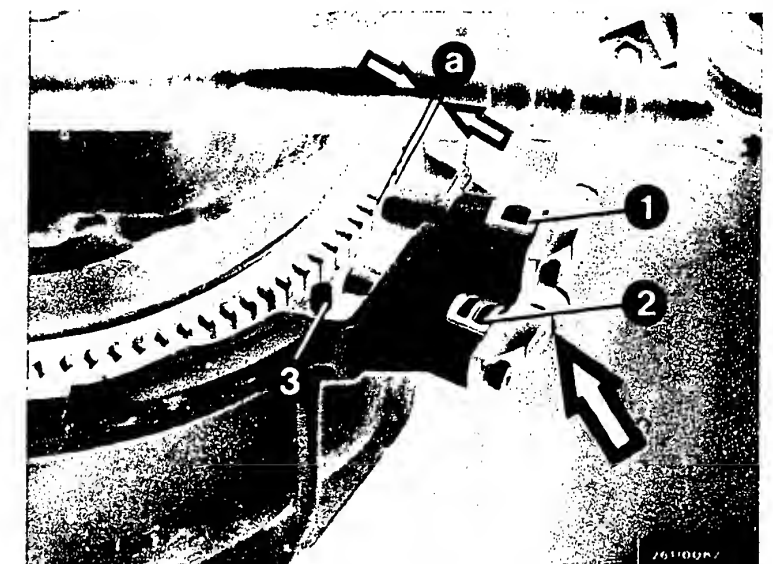
On assembly, make certain that the couplings are correctly assigned!

Make certain that there is a proper seating and latching of the spring contacts in the plug! It must not be possible to shove the spring contacts back!



Top view of the control unit plug (35-pole), with terminal numbers.
Arrow = "lug" with mechanical coding.

- 1=Rotational-speed sensor (D)
- 2=Reference mark sensor (B)
- 3=Reference mark
- a=Air gap
- Arrow = Identification marking for reference mark sensor



C20

Testing with universal test adapter
BMW

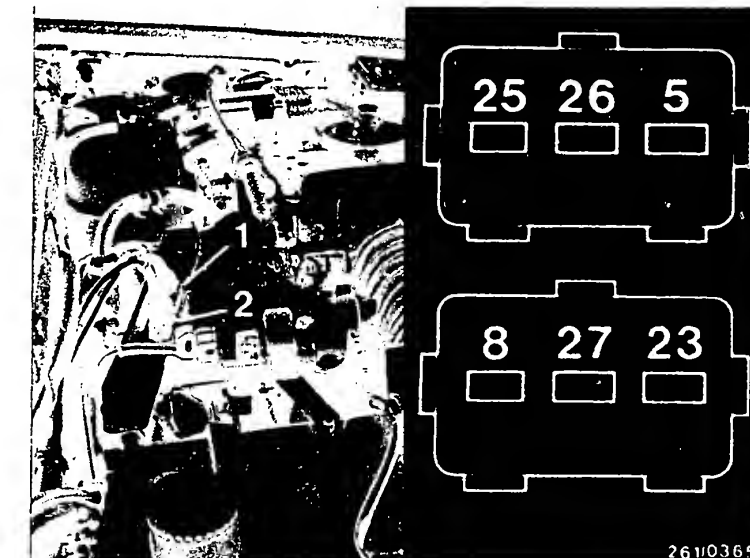


C21

Testing with universal test adapter
BMW

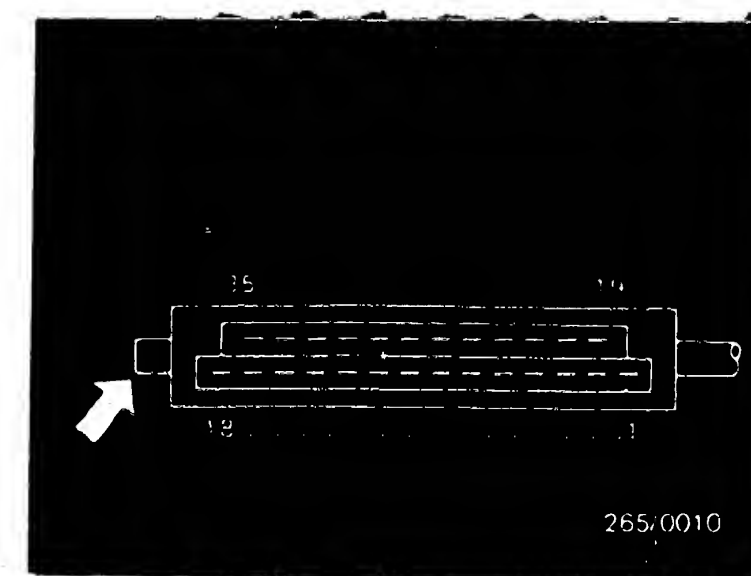


TEST STEP 2:			
Operation		Reading	Testing
Program switch "V" in setting:	↓	Resistance must be greater than 1 M Ω	Component: Reference mark sensor
Program switch " Ω " in setting:	2		
Test equipment: Ohmmeter		<div>yes</div> <div>↓</div> <div>Continue test- ing with next test step.</div> <div>no</div> <div>↓</div>	Operation: Insulation from Term. 25 to ground
Scale: 10 M Ω			Malfunction: Resistance less than 1 M Ω
Connection: Test sockets	Ω		
Operation in vehicle: Switch off ignition.			



- 1 = Plug connection for reference mark sensor, with gray plug
2 = Plug connection for rotational-speed sensor, with black plug

Top view of control unit plug (35-pole) with terminal numbers.
Arrow = "Lug" with mechanical coding



Trouble-shooting:

Check plug connection for corrosion and damage to insulation. Take apart the connection and on the plug that leads to the test adapter, jump terminals 25 and 26 with a wire. Repeat the test: If the reading is now O.K., take out and replace the rotational-speed sensor. If the reading is still less than the specified value, the leads from the control unit plug Term. 25 or Term. 26 to the plug have damaged insulation (e.g., ground short due to wear).

Continued on D1/D2.

C22

Testing with universal test adapter
BMW



C23

Testing with universal test adapter
BMW



Trouble-shooting TEST STEP 2 (continued)

- Replace the sensor.

To take out and replace the sensor, unscrew the socket hex screw on the sensor. Remove dirt deposits on the sensor. If necessary, insert two screwdrivers into the recesses at the left and the right of the sensor and lift the sensor.

Before putting the sensor in, make certain that no metal parts cling to it. (The sensors contain permanent magnets.) Grease the sensors with Molykote Longterm 2.

Do not confuse the sensors one for the other on installation!

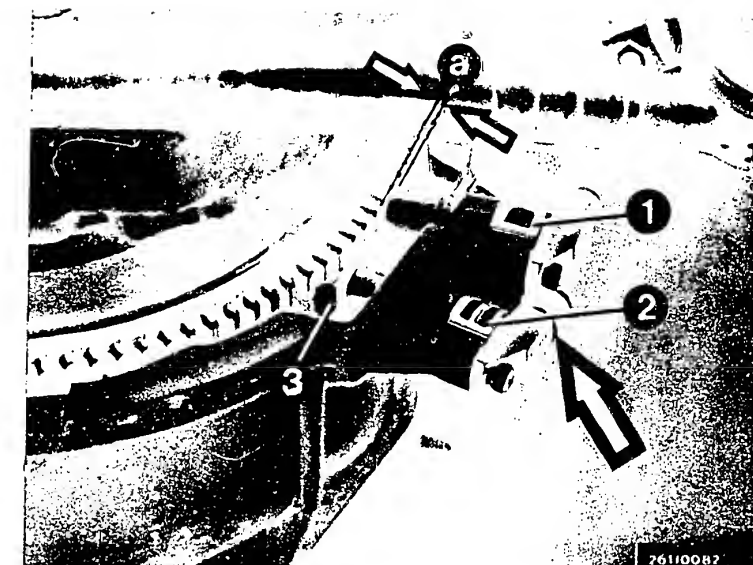
Watch the identification marking:

The reference mark sensor is identified with a cable binder.

The sensors are inserted into the hole down to the stop, and screwed tight. Do not use any force when putting them in.

On assembly, make certain that the couplings are correctly assigned!

Make certain that there is a proper seating and latching of the spring contacts in the plug! It must not be possible to shove the spring contacts back!



- 1 = Rotational-speed sensor (D)
- 2 = Reference mark sensor (B)
- 3 = Reference mark
- a = air gap
- Arrow = Identification marking for reference mark sensor

D1

Testing with universal test adapter

BMW



D2

Testing with universal test adapter

BMW



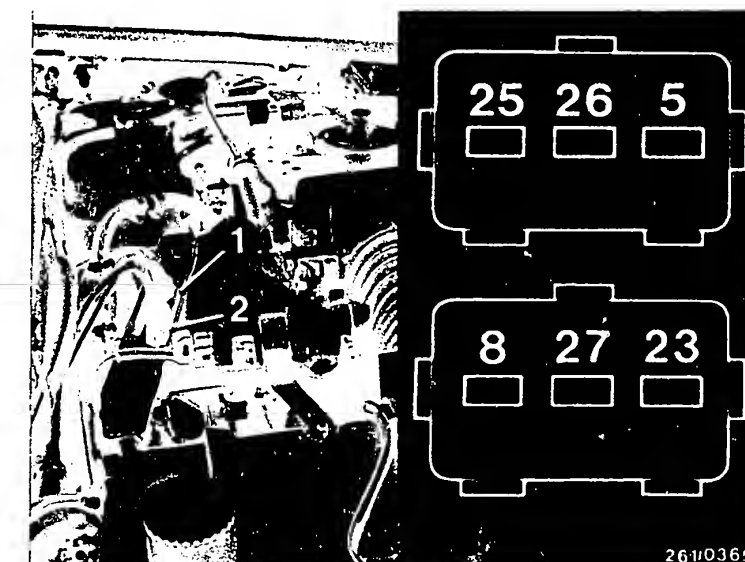
TEST STEP 3:		
Operation	Reading	Testing
<div>Program switch "V" in setting:</div>	<div>↓</div> <div>Ohmmeter must read <u>0.6 ... 1.6 kΩ</u></div>	<div>Component:</div> <div>Rotational-speed sensor</div>
<div>Program switch "Ω" in setting:</div>		<div>3</div>
<div>Test equipment: Ohmmeter</div>	<div>yes</div> <div>no</div> <div>Continue testing with <u>next test</u> <u>step.</u></div>	<div>Operation:</div> <div>Coil resistance between Term. 8 and Term. 27</div>
<div>Scale: 0 to 10 kΩ</div>		
<div>Connection: Test sockets</div>		<div>Ω</div>
<div>Operation in vehicle: Switch off ignition</div>		
		<div>Malfunction:</div> <div>Resistance not within tolerance</div>

Trouble-shooting:

- Repeat the measurement directly on the sensor plug.
- Check the plug connection: Corrosion, loose contact, (it must not be possible to shove the spring contacts back!)
- Check the leads from the rotational-speed sensor Term. 8 and Term. 27 to the control unit plug Term. 8 and Term. 27.
- Take out and replace the sensor.

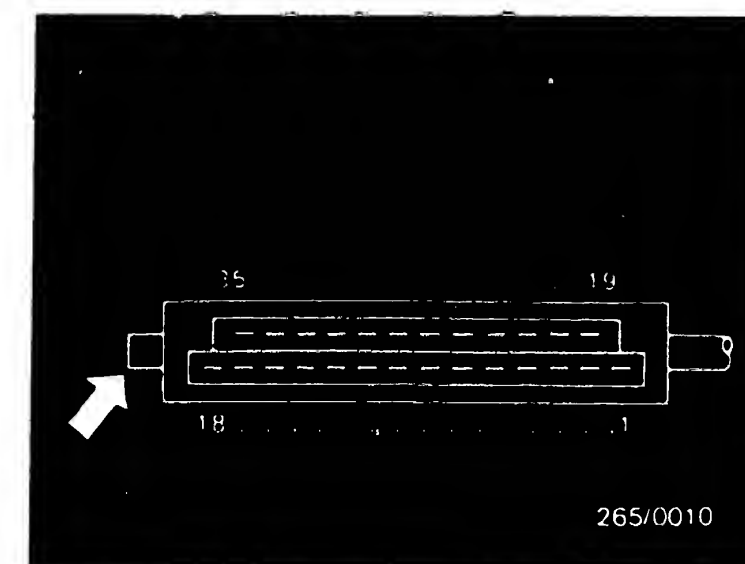
To take out and replace the sensor, unscrew the socket hex screw on the sensor. Remove dirt deposits on the sensor. If necessary, insert two screwdrivers into the recesses at the left and the right of the sensor and lift the sensor.

Continued on D5/D6



- 1 = Plug connection for reference mark sensor, with gray plug
- 2 = Plug connection for rotational speed sensor, with black plug

Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug" with mechanical coding.



D3

Testing with universal test adapter
BMW



D4

Testing with universal test adapter
BMW



Trouble-shooting TEST STEP 3 (continued)

Before putting the sensor in, make certain that no metal parts cling to it. (The sensors contain permanent magnets.) Grease the sensors with Molykote Longterm 2.

Do not confuse the sensors one for the other on installation!

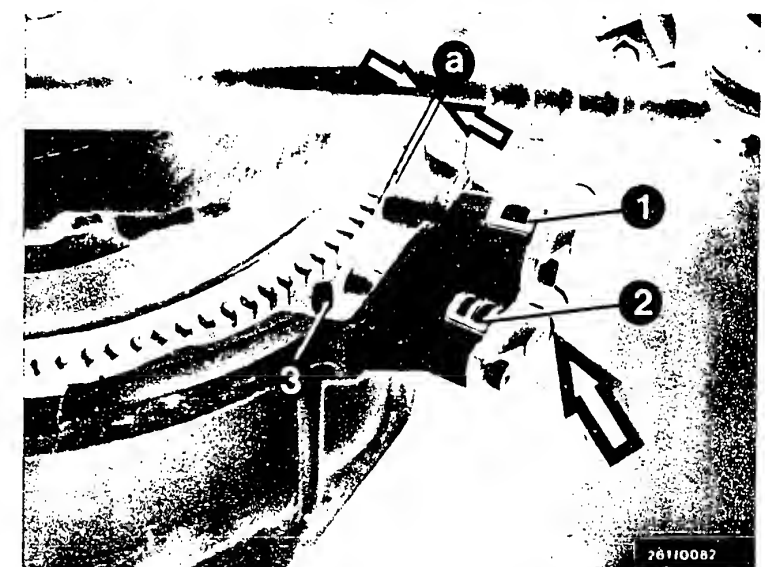
Watch the identification marking:

The reference mark sensor is identified with a cable binder.

The sensors are inserted into the hole down to the stop, and screwed tight. Do not use any force when putting them in.

On assembly, make certain that the couplings are correctly assigned!

Make certain that there is a proper seating and latching of the spring contacts in the plug! It must not be possible to shove the spring contacts back!



1 = Rotational-speed sensor (D)

2 = Reference mark sensor (B)

3 = Reference mark

a = Air gap

Arrow = Identification marking for
reference mark sensor

D5

Testing with universal test adapter
BMW

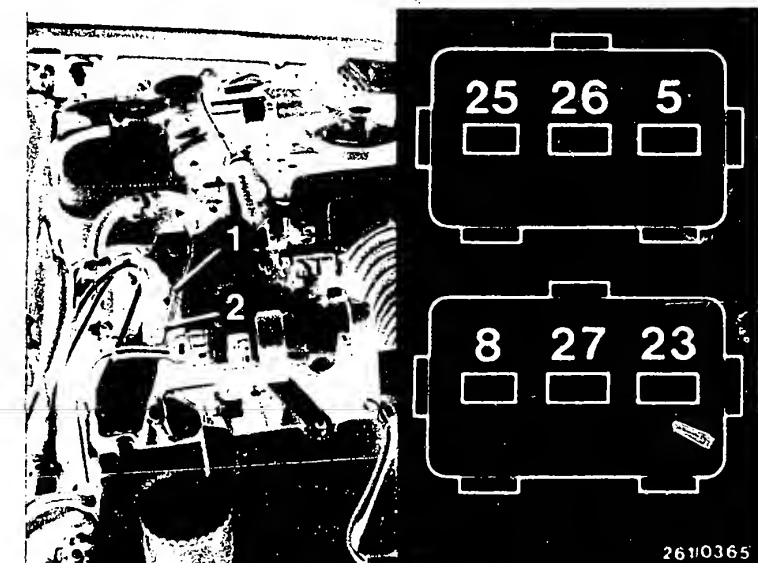


D6

Testing with universal test adapter
BMW

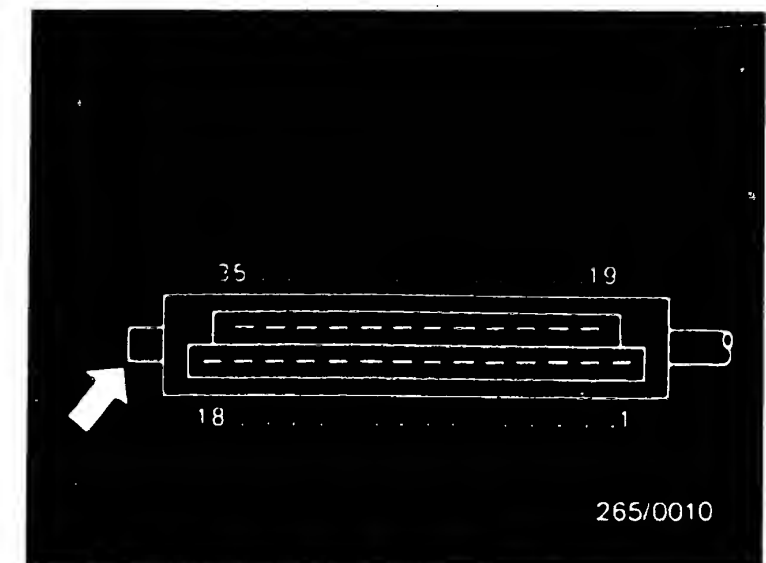


TEST STEP 4:		
Operation	Reading	Testing
Program switch "V" in setting:	Ohmmeter must read 0.6 ... 1.6 k Ω	Component: Reference mark sensor
Program switch " Ω " in setting:		
Test equipment: Ohmmeter	<div> <div>yes</div> <div>no</div> </div>	<div> <div>Operation: Coil resistance between Term. 25 and Term. 26</div> <div>Malfunction: Resistance not within tolerance</div> </div>
Scale: 0 to 10 k Ω		
Connection: Test sockets		
Operation in vehicle: Switch off ignition.		



- 1 = Plug connection for reference mark sensor, with gray plug
2 = Plug connection for rotational speed sensor, with black plug

Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug" with mechanical coding.



Trouble-shooting:

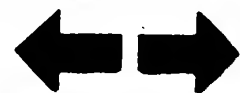
- Repeat the measurement directly on the sensor plug.
- Check the plug connection: Corrosion, loose contact, (it must not be possible to shove the spring contacts back!)
- Check the leads from the reference-speed sensor Term. 25 and Term. 26 to the control unit plug Term. 25 and Term. 26.
- Take out and replace the sensor.

To take out and replace the sensor, unscrew the socket hex screw on the sensor. Remove dirt deposits on the sensor. If necessary, insert two screwdrivers into the recesses at the left and the right of the sensor and lift the sensor.

Continued on D9/D10

D7

Testing with universal test adapter
BMW



D8

Testing with universal test adapter
BMW



Trouble-shooting TEST STEP 4 (continued)

Before putting the sensor, make certain that no metal parts cling to it. (The sensors contain permanent magnets.) Grease the sensors with Molykote Longterm.

Do not confuse the sensors one for the other on installation!

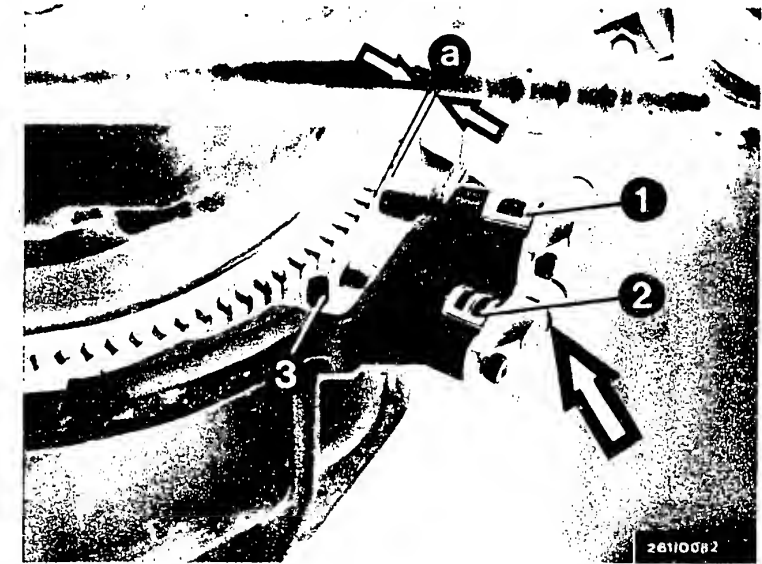
Watch the identification marking:

The reference mark sensor is identified with a cable binder.

The sensors are inserted into the hole down to the stop, and screwed tight. Do not use any force when putting them in.

On assembly, make certain that the couplings are correctly assigned!

Make certain that there is a proper seating and latching of the spring contacts in the plug! It must not be possible to shove the spring contacts back!



1 = Rotational-speed sensor (D)

2 = Reference mark sensor (B)

3 = Reference mark

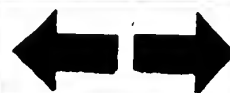
a = Air gap

Arrow = Identification marking for reference mark sensor

D9

Testing with universal test adapter

BMW




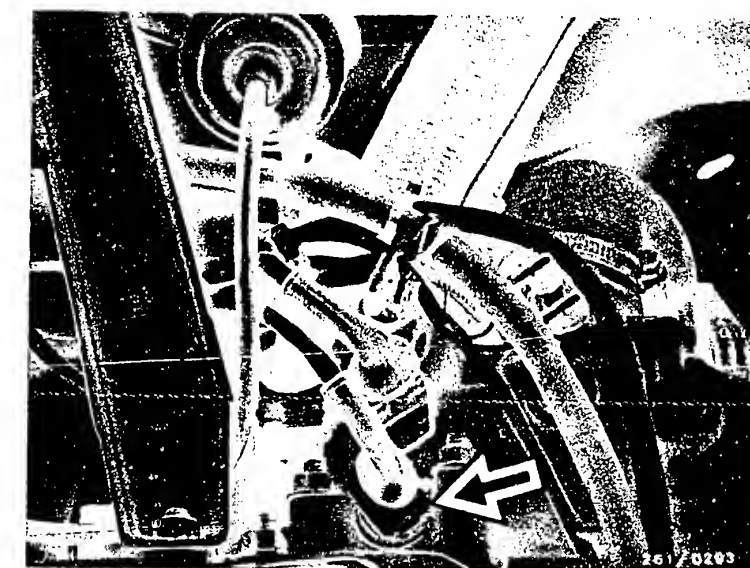
D10

Testing with universal test adapter

BMW



TEST STEP 5:			
Operation		Reading	Testing
<u>Program switch "V"</u> <u>in setting:</u>		Measurement depends on temperature, i.e., watch the engine temperature. At ambient temperature (+15°C...+30°C): <u>1.3...3.6 kΩ</u>	<u>Component:</u> Temperature sensor engine (NTC II)
<u>Program switch "Ω"</u> <u>in setting:</u>	5	With engine at normal operating temperature (approx. +80°C): <u>250...390 Ω</u>	
<u>Test equipment:</u> Ohmmeter			<u>Operation:</u> Resistance between Term. 13 and ground
<u>Scale:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω	<div>yes ↓ Continue testing with <u>next test step.</u></div>	<u>Malfunction:</u> Resistance not within tolerance. Watch the temperature!
<u>Operation in vehicle:</u> Switch off ignition		<div>no ↓</div>	



Arrow = Temperature sensor, engine (NTC II), white plug

Trouble-shooting:

- Disconnect the plug on the temperature sensor and measure the resistance directly. If need be, take out and replace the temperature sensor.
- Check the leads from the temperature sensor to the control unit plug Term. 13 and to the ground terminal.
- Eliminate contact resistances in the plug connections. It must not be possible to shove the spring contacts back!

D11




Testing with universal test adapter
BMW



D12

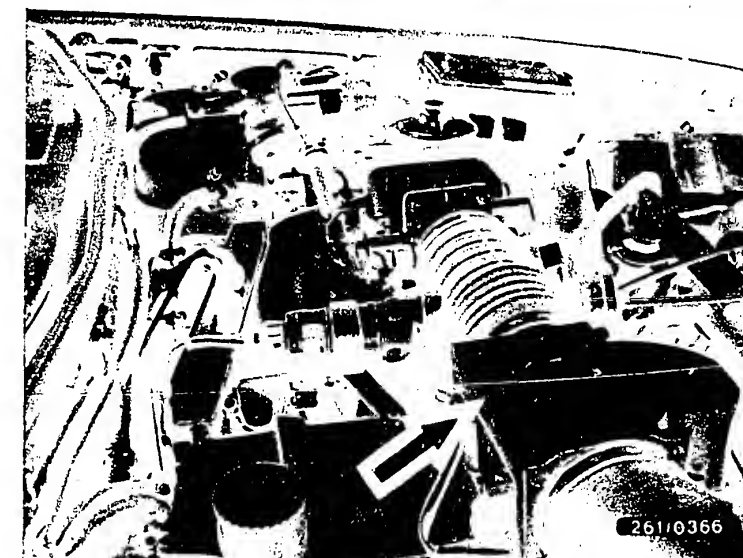
Testing with universal test adapter
BMW



TEST STEP 6:			
Operation		Reading	Testing
Program switch "V" in setting:		Measurement depends on: temperature, i.e., watch air temperature in the intake channel. At ambient temperature (+15°C...+30°C) 1.45 ... 3.3 kΩ	Component: Temperature sensor, air (NTC I)
Program switch "Ω" in setting:	6		
Test equipment: Ohmmeter		With engine at normal operating temperature (approx. +80°C): 280 ... 360 Ω	Operation: Resistance between Term. 22 and ground
Scale: 0 to 10 kΩ			
Connection: Test sockets	Ω	yes 	Malfunction: Resistance not within tolerance. Watch the temp- erature!
Operation in vehicle: Switch off ignition		no 	
		Continue testing with next test step.	

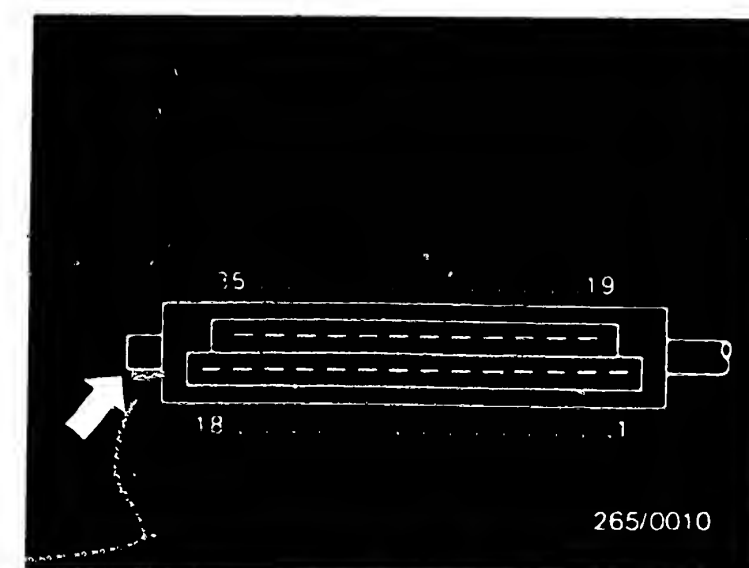
Trouble-shooting:

- Disconnect plug at the air-flow sensor and measure resistance directly at Term. 22 and Term. 6.
If the measurement is not within tolerance, take out and replace the air-flow sensor.
- Leads from the air-flow sensor Term. 6 and Term. 22 to the control unit plug Term. 6 and Term. 22.
- Eliminate contact resistances in the plug connections.
It must not be possible to shove the spring contacts back!



Arrow = Air-flow sensor with NTC I

Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug" with mechanical coding.



D 13

Testing with universal test adapter
BMW



D 14

Testing with universal test adapter
BMW



TEST STEP 7:

Operation

Program switch "V"
in setting:



Program switch "Ω"
in setting:

7

Test equipment:
Ohmmeter

Scale:
0 to 10 kΩ

Connection:
Test sockets

Ω

Operation in vehicle:
Switch ignition off

Reading

Manuel transmission:
Less than 10 Ω
Automatic transmission
Greater than 1 MΩ

yes

no

Continue testing
with test step
9.
(Test step 8 is
not used)

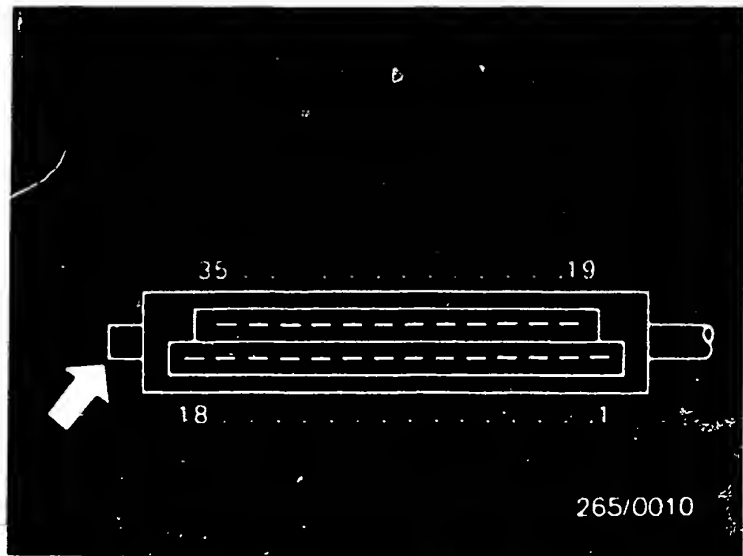
Testing

Component:
Connection between term. 10
and ground/auxiliary plug-in
connection on cable harness
near control unit plug.

Operation:
Characteristic-map switching

Malfunction:

Resistance
Manual transmission:
greater than 10 Ω
Automatic transmission:
less than 10 Ω



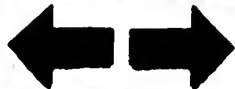
Top view of control unit plug (35-
pole), with terminal numbers.
Arrow = "Lug" with mechanical coding.

Trouble-shooting

- Connect multiple plug 10 to ground; with vehicles having automatic transmission, separate.

D 15

Testing with universal test adapter
BMW

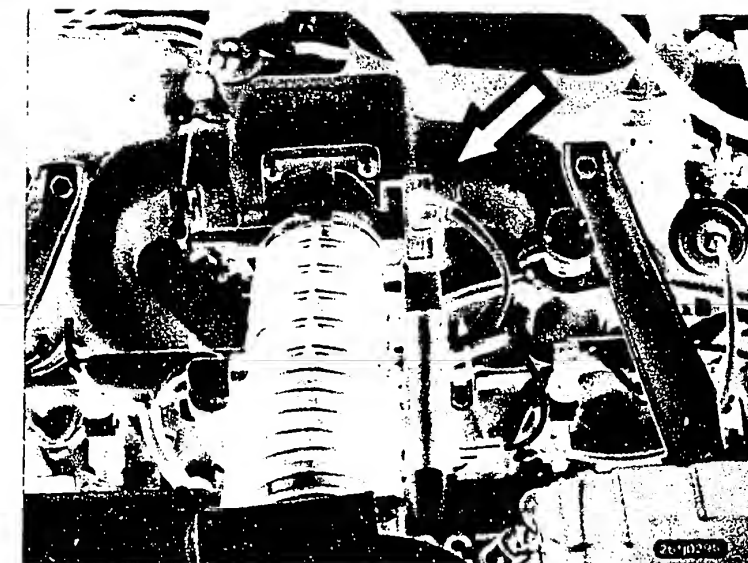


D 16

Testing with universal test adapter
BMW



TEST STEP 9: (Test step 8 is not used)		
Operation:		Reading:
Program switch "V" in setting:	↓	Accelerator pedal in at rest position: less than 10 Ω
Program switch "Ω" in setting:	9	(Measurement is affected by the resistor in the adapter.)
Test equipment: Ohmmeter		Step down on the accelerator. (Part load range): ∞ Ω 1)
Scale: 0 to 10 kΩ		
Connection: Test sockets	Ω	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> yes ↓ Continue testing with next test step. </div> <div style="text-align: center;"> no ↓ </div> </div>
Operation in vehicle: Switch ignition off		



Arrow = Throttle valve switch

Trouble-shooting:

1) Adjusting the throttle valve switch:

Undo the fastening screws. Turn the control lever to full throttle and slowly move it back to the idle stop. Continue turning the switch in a clockwise direction until the contact switches perceptibly (reading less than 10 Ω). Tighten screws.

Continued on D19/D20



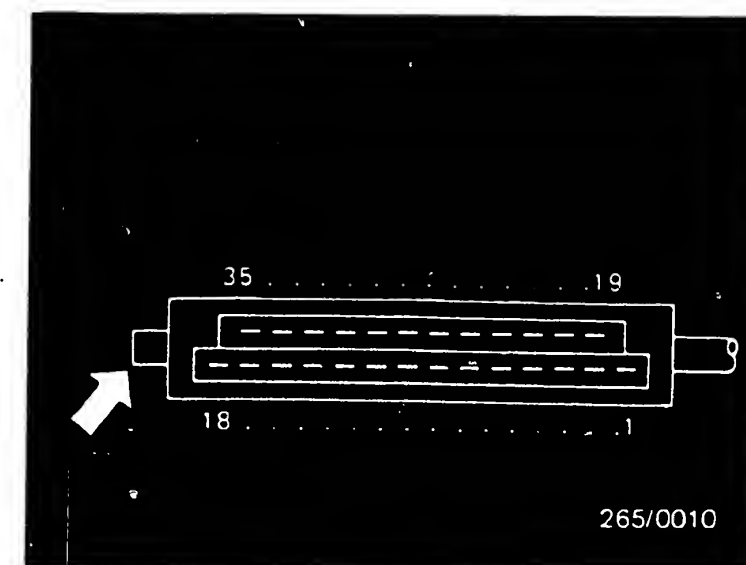
Trouble-shooting, throttle valve switch (continued)

Checking: Slowly open the accelerator pedal in the direction of full load. After being moved a short distance, the reading must shift to ∞ .

If no adjustment is possible:

Check the throttle valve switch (idle contact) and the leads from the throttle valve switch to the control unit plug Term. 2 and to the ground terminal.
Eliminate contact resistances.

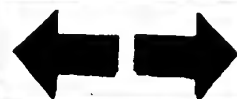
It must not be possible to shove spring contacts back!



Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug" with mechanical coding.

D 19

Testing with universal test adapter
BMW



D 20

Testing with universal test adapter
BMW



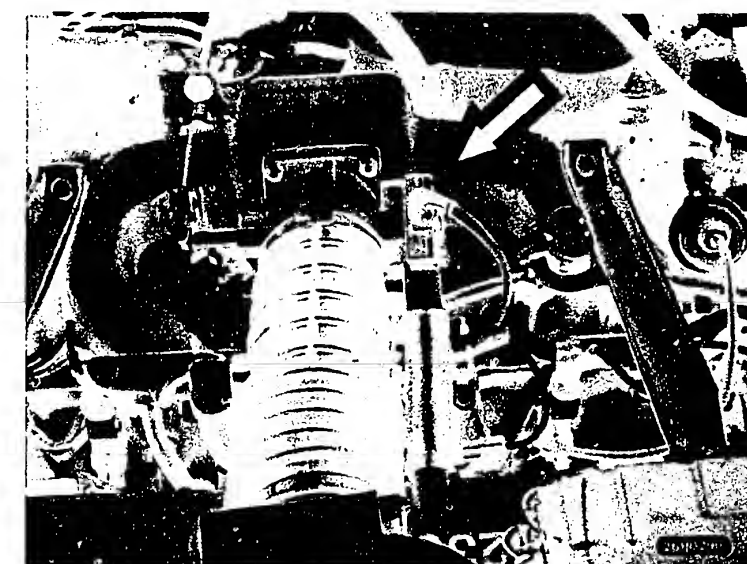
TEST STEP 10 (not applicable for vehicles with electronic transmission control)			
Operation		Reading	Testing
Program switch "V" in position	↓	Accelerator pedal in part load setting:	Component: Throttle valve switch
Program switch "Ω" in position	10	$\infty \Omega$ Acceleration pedal at full-load stop	
Test equipment: Ohmmeter		less than <u>10 Ω</u> ¹⁾ (Measurement is affected by the resistor in the adapter)	Operation: Full-load contact between Terminal 3 and ground
Scale 0 to 10 kΩ			Malfunction: Resistance at full load greater than 10 Ω or $\infty \Omega$.
Connection: Test sockets	Ω	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> yes ↓ Continue testing with next test step. </div> <div style="text-align: center;">no ↓</div> </div>	
Operation in vehicle: Switch off ignition			

Trouble-shooting:

- 1) Checking: Move the throttle valve in the direction of full load. Shortly before the full-load stop for the control lever, the reading shifts to values less than 10 Ω. (Full-load contact closed).

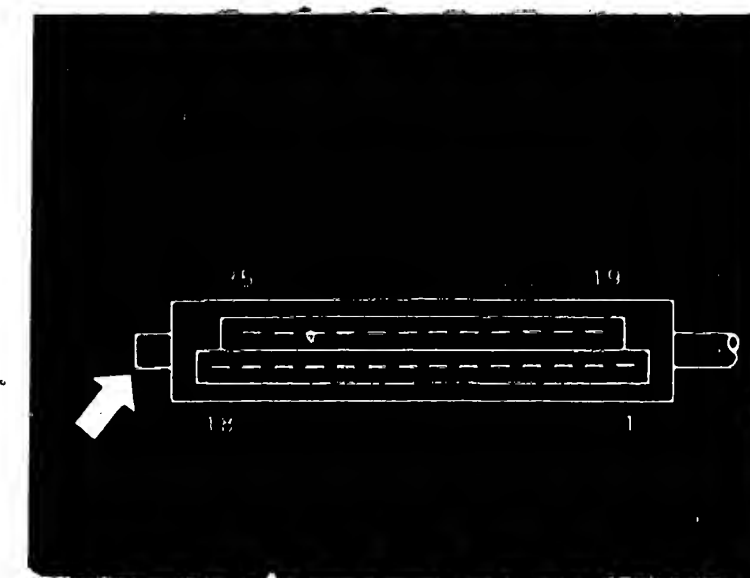
Reading greater than 10 Ω or $\infty \Omega$:

Check whether the throttle valve opens completely. Check the bowden cable from the accelerator pedal to the throttle valve.
Check the throttle-valve switch and the lead from the throttle-valve switch Term. 3 to the control unit plug Term. 3.
Eliminate contact resistances.
It must not be possible to shove spring contacts back!



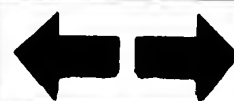
Arrow = Throttle valve switch

Top view of control unit plug (35-pole) with terminal numbers.
Arrow = "Lug" with mechanical coding.



D21

Testing with universal test adapter
BMW



D22

Testing with universal test adapter
BMW



TEST STEP 11			
Operation		Reading	Testing
Program switch "V" in setting:	↓	Ohmmeter must read less than 10 Ω	Component: Ground lead
Program switch " Ω " in setting:	11	(Measurement is affected by the resistor in the adapter)	
Test equipment Ohmmeter		yes	Operation: Contact resistance between Term. 16 and ground
Scale: 0 to 10 k Ω		↓	
Connection: Test sockets	Ω	Continue testing with next test step	Malfunction: Resistance greater than 10 Ω
Operation in vehicle: Switch off ignition		no	

Trouble-shooting:

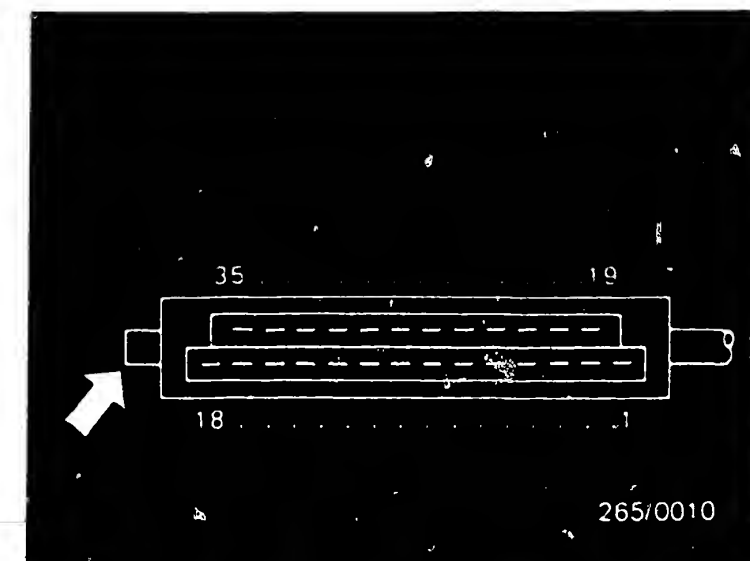
To test, disconnect the wiring harness plug from the test adapter and, if necessary, use a wiring diagram.

Check the following leads for continuity using an ohmmeter (specified value approx. 0 Ω):

- From the control unit plug Term. 16 to the ground terminal.
- From the control unit plug Term. 5 to the ground terminal.

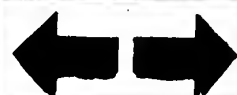
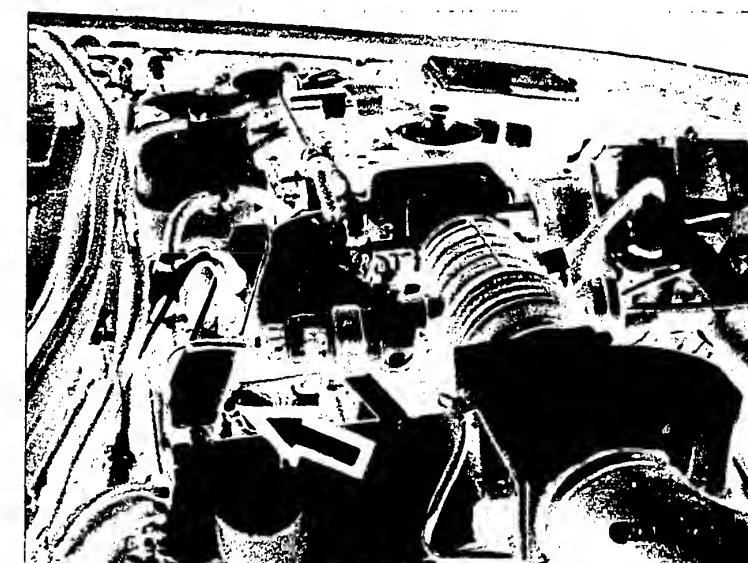
Eliminate contact resistances at the connections.

It must not be possible to shove spring contacts back!



Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug", with mechanical coding

Arrow = Motronic ground terminal



TEST STEP 12			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch "V"</u> <u>in setting:</u>	↓	Ohmmeter must read <u>less than 10 Ω.</u>	<u>Component:</u> Ground Lead
<u>Program switch "Ω"</u> <u>in setting:</u>	12	(Measurement is affected by the resistor in the adapter.)	
<u>Test equipment:</u> Ohmmeter		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> <u>test step</u></div></div> <div><div>no</div><div>↓</div><div></div></div>	<u>Operation:</u> Contact resistance between Term. 17 and ground
<u>Scale:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω		
<u>Operation in vehicle:</u> Switch off ignition			
			<u>Malfunction:</u> Resistance greater than 10 Ω

Trouble-shooting:

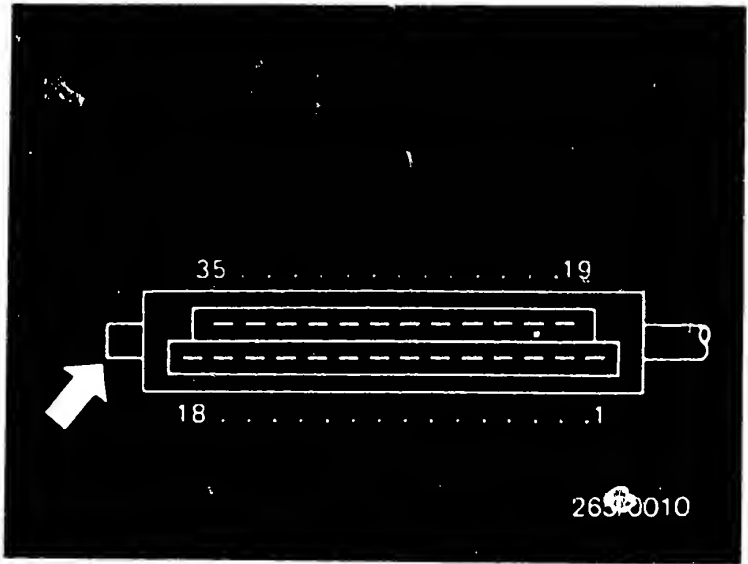
To test, disconnect the wiring harness plug from the test adapter and, if necessary, use a wiring diagram.

Check the following leads for continuity using an ohmmeter (specified value approx. 0 Ω):

- From the control unit plug Term. 17 to the ground terminal.
- From the control unit plug Term. 5 to the ground terminal.

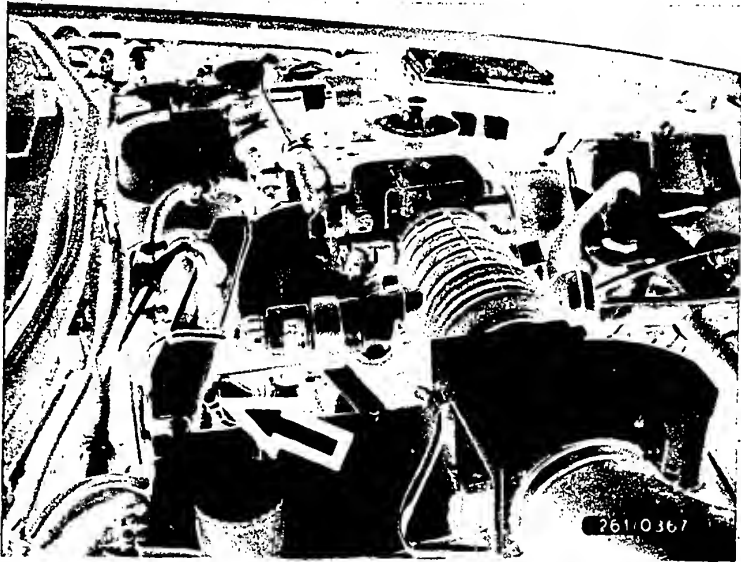
Eliminate contact resistances at the connections.

It must not be possible to shove spring contacts back!



Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug", with mechanical coding

Arrow = Motronic ground terminal



TEST STEP 13:		
Operation	Reading	Testing
Program switch "V" in position:	↓ Ohmmeter must read less than 10 Ω	Component: Ground Lead
Program switch "Ω" in position:	13 (Measurement is affected by the resistor in the adapter)	
Test equipment: Ohmmeter		Operation: Contact resistance between Term. 19 and ground
Scale: 0 to 10 k Ω		
Connection: Test sockets	Ω	Malfunction: Resistance greater than 10 Ω
Operation in vehicle: Switch off ignition	<div> <div>yes</div> <div>↓</div> <div>Continue testing with next test step</div> </div> <div> <div>no</div> <div>↓</div> </div>	

Trouble-shooting:

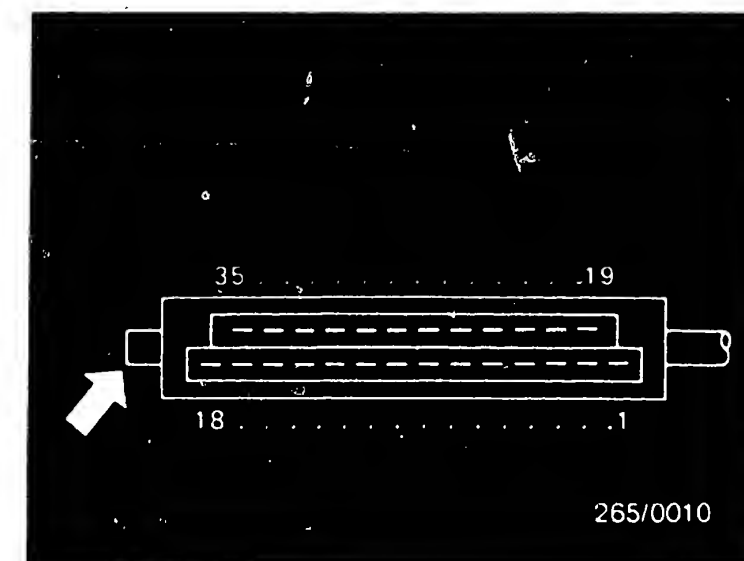
To test, disconnect the wiring harness plug from the test adapter and, if necessary, use a wiring diagram.

Check the following leads for continuity using an ohmmeter (specified value approx. 0 Ω):

- From the control unit plug Term. 19 to the ground terminal.
- From the control unit plug Term. 5 to the ground terminal.

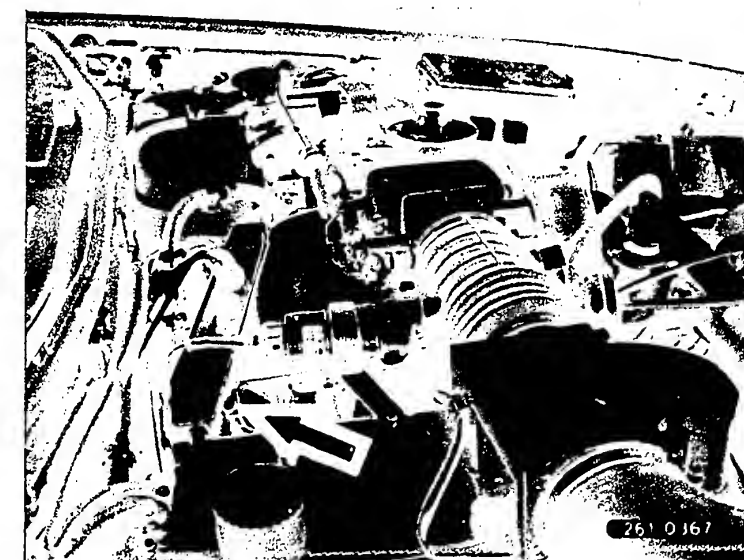
Eliminate contact resistances at the connections.

It must not be possible to shove spring contacts back!



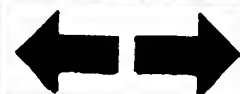
Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug", with mechanical coding

Arrow = Motronic ground terminal



E3

Testing with universal test adapter
BMW



E4

Testing with universal test adapter
BMW



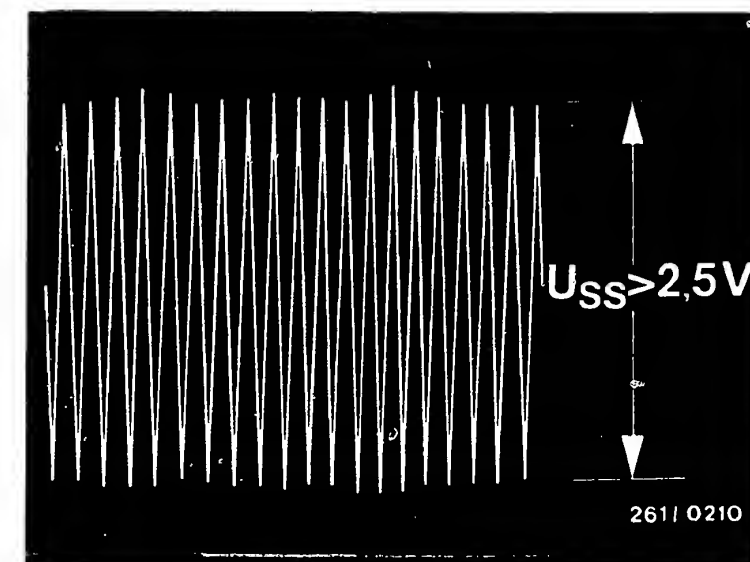
TEST STEP 16 (test steps 14 and 15 not applicable)		
Operation	Reading	Testing
Program switch "V" in setting:	1	Component: Rotational-speed sensor
Program switch "Q" in setting:	15	
Test equipment: Motortester, oscilloscope	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> yes ↓ Continue testing with <u>next test</u> step </div> <div style="text-align: center;"> no ↓ </div> </div>	Operation: Amplitude (signal) at Terminals 8 and 27
Scale: Special input		Malfunction: No signal or too small a signal. Incorrect signal.
Connection: Test wells. Red clip to red well, black clip to black well		
Operation in vehicle: Shift into neutral and start engine		

Trouble-shooting:

No signal, or too small a signal:

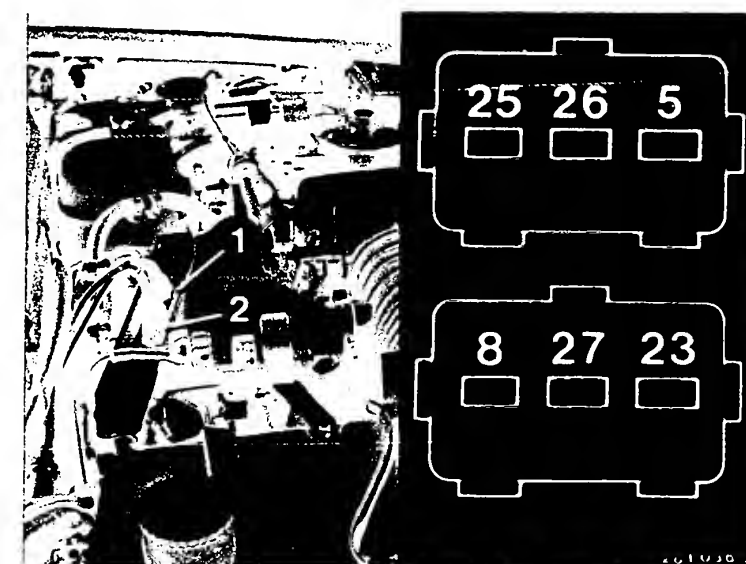
- Cranking speed less than 200 min^{-1} .
Charge the battery.
- Check the nominal air gap $a = 0.8 \text{ mm}$:
Remove the cover plate from the ring gear housing.

Continued on E7/E8



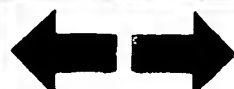
Rotational-speed sensor signal

- 1 = Plug connection for reference
mark sensor, with gray plug
2 = Plug connection for rotational-
speed sensor, with black plug



E5

Testing with universal test adapter
BMW



E6

Testing with universal test adapter
BMW



Trouble-shooting TEST STEP 16 (continued)

- Taking out and replacing the rotational-speed sensor:
Unscrew the socket hex screw on the sensor.
Remove dirt deposits on the sensor. If necessary,
insert two screwdrivers into the recesses at the left
and right of the sensor and lift the sensor.
- Incorrect signal (severely extended, in the figure at
the bottom):

Severely damaged tooth on the starting motor ring gear
take out and replace the ring gear.

Before installing the sensors, make certain that no metal
parts are clinging to the sensor. (The sensors contain
permanent magnets.) Grease the sensors with Molykote
Longterm 2.

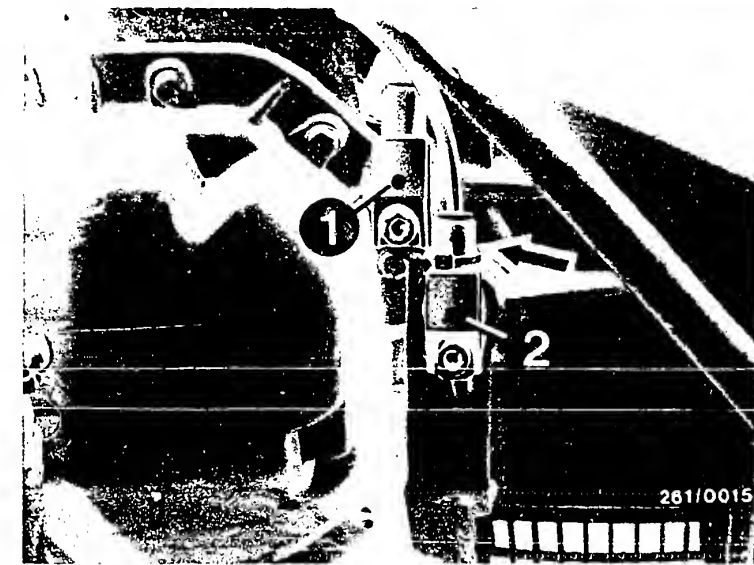
Do not confuse sensors one for the other on installation!

Watch the identification marking: Reference mark sensor
with identification, and/or gray plug.
Rotational-speed sensor without, black plug.

The sensors are inserted into the hole as far as the stop
and screwed tight. Do not use any force when putting
them in.

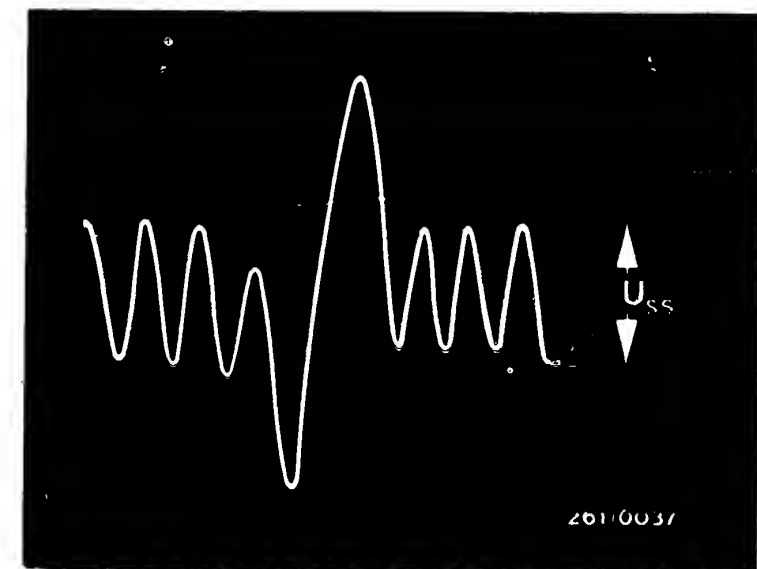
On putting them in, make certain that the couplings are
properly assigned!

Watch for proper seating and latching of the spring con-
tacts in the plugs! It must not be possible to shove the
spring contacts back!



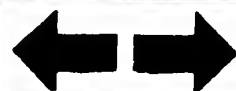
1 = Rotational-speed sensor
2 = Reference mark sensor
Arrow = Identification marking for
reference mark sensor

Defective rotational-speed sensor
signal



E7

Testing with universal test adapter
BMW



E8

Testing with universal test adapter
BMW



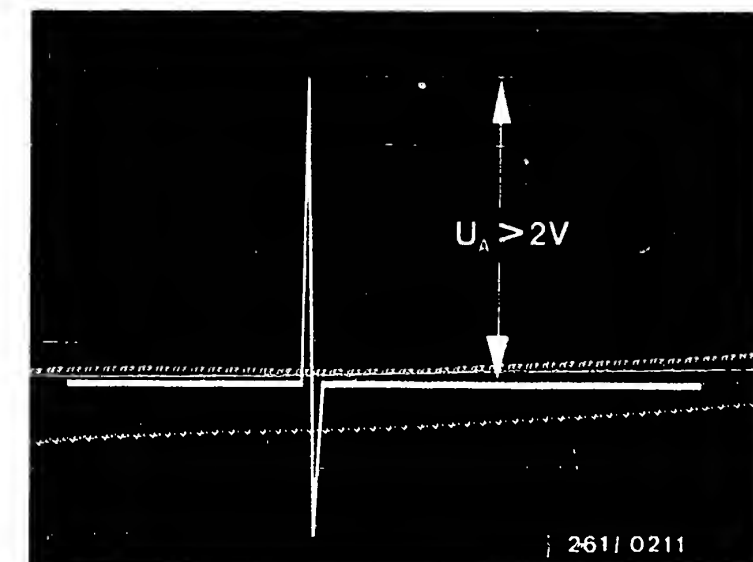
TEST STEP 17:

Operation		Reading	Testing
Program switch "V" in setting	2	Reference mark sensor - signal (see figure at top)	Component: Reference mark sensor
Program switch "Ω" in setting:	15	Lever at stop at left (calibrated voltage range)	Operation: Amplitude (signal) at Terminals 25 and 26
Test equipment: Motortester, oscilloscope			
Scale: Special input			
Connection: Test wells, red clip to red well, black clip to black well			
Operation in vehicle: Shift into neutral and start the engine.			
		yes ↓ Continue testing with test step 20. (Test steps 18 and 19 are not used.)	no ↓ Malfunction: No signal or too small a signal. Incorrect signal: Negative peak comes first.

Trouble-shooting:

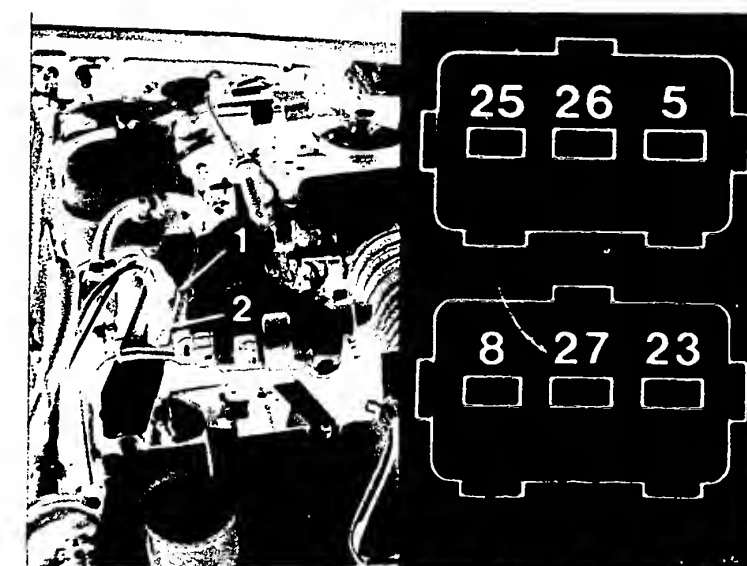
No signal, or too small a signal:

- Cranking speed under 200 min : Charge the battery.



Reference mark sensor signal.
Positive peak must come first.

- 1 = Plug connection for reference mark sensor with gray plug
- 2 = Plug connection for rotational-speed sensor, with black plug



Continued on E11/E12

E9

Testing with universal test adapter
BMW



E10

Testing with universal test adapter
BMW



Trouble-shooting TEST STEP 17 (continued)

- Check the nominal air gap $a = 0.8 \text{ mm}$:
Remove the coverplate from the ring gear housing
The reference mark (3) can be moved up to the reference mark sensor by turning the ring gear, e.g., with a wrench. Measurement of the air gap (a) with a feeler gauge.

Incorrect signal:

- The signal is incorrect if the negative peak comes first. Check assignment of leads according to the wiring diagram and the figure at the right.
- Taking out and replacing the reference mark sensor:
Unscrew the socket hex screw on the sensor. Remove dirt deposits on the sensor. If necessary, insert two screwdrivers into the recesses at the left and the right of the sensor and lift the sensor.

Before putting the sensor in, make certain that no metal parts cling to it. (The sensors contain permanent magnets.) Grease the sensors with Molykote Longterm.

Do not confuse the sensors one for the other on installation!

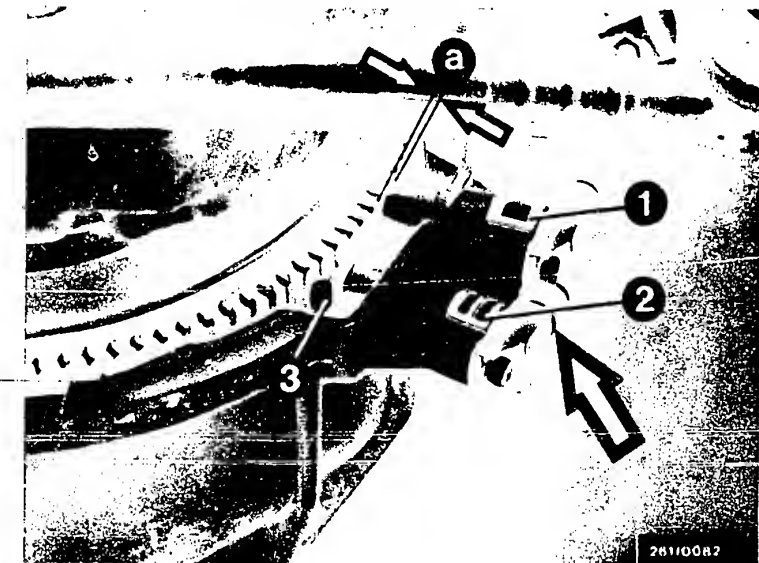
Watch the identification marking:

The reference mark sensor is identified with a cable binder

The sensors are inserted into the hole down to the stop, and screwed tight. Do not use any force when putting them in.

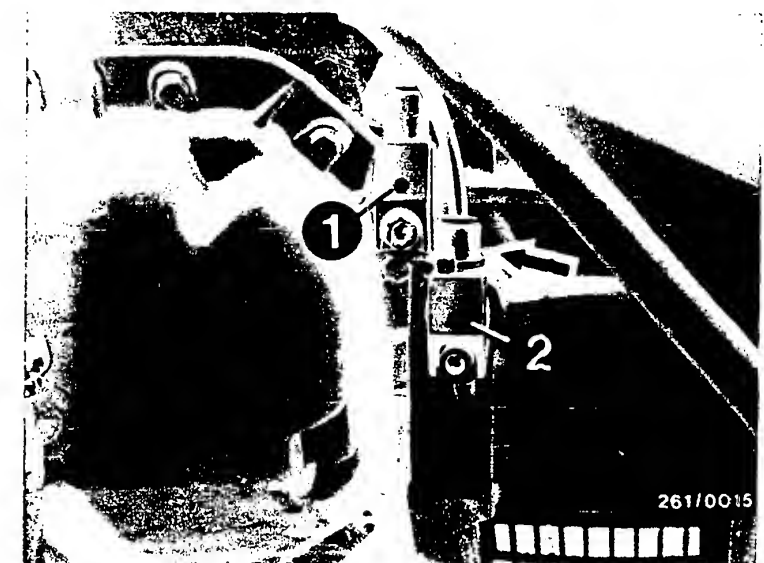
On assembly, make certain that the couplings are correctly assigned!

Make certain that there is a proper seating and latching of the spring contacts in the plug! It must not be possible to shove the spring contacts back!



1 = Rotational-speed sensor (D)
2 = Reference mark sensor (B)
3 = Reference mark
a = Air gap
Arrow = Identification marking for reference mark sensor

1 = Rotational-speed sensor
2 = Reference mark sensor
Arrow = Identification marking on the reference mark sensor



E11

Testing with universal test adapter
BMW

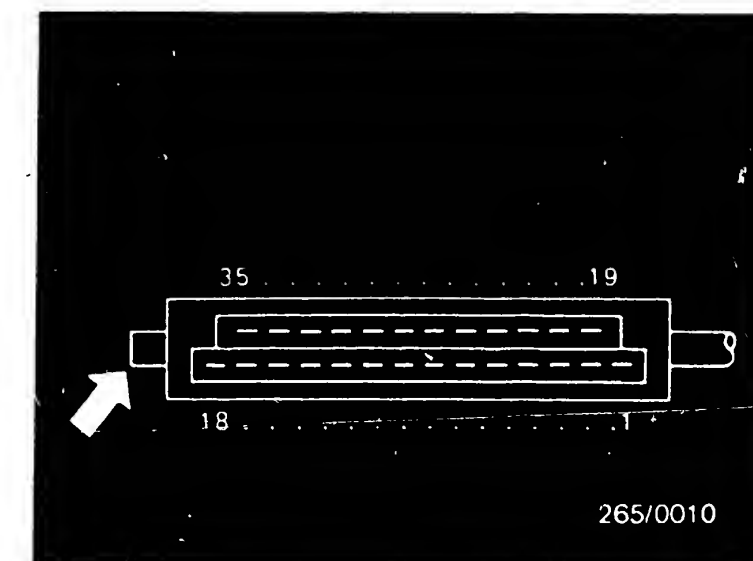


E12

Testing with universal test adapter
BMW



TEST STEP 19 if air conditioner installed. (TEST STEP 18 not applicable)			
Operation		Reading	Testing
Program switch position "V"	4	Switch on air conditioner (compressor must operate) greater than 8 V	Component: Lead to air conditioner
Program switch position "Ω"	15		
Measuring equipment: Voltmeter		<div>yes</div> <div>no</div>	Operation: Voltage after switching on air conditioner. Term. 29 to term. 5 Malfunction: Voltage less than 8 V
Measuring range: 15 V			
Connection: Test sockets (red = +, black = ground)	V		
Operation in vehicle: Switch on ignition		Continue testing with next test step	



Top view of control-unit plug (35-pin) with terminal numbers.
Arrow="Lug" with mechanical encoding

Trouble-shooting:

- Check lead from control-unit plug term. 29 to switch of air conditioner.
- Check plug-in connections for corrosion, latching and wire break.

E13

Test with universal test adapter
BMW

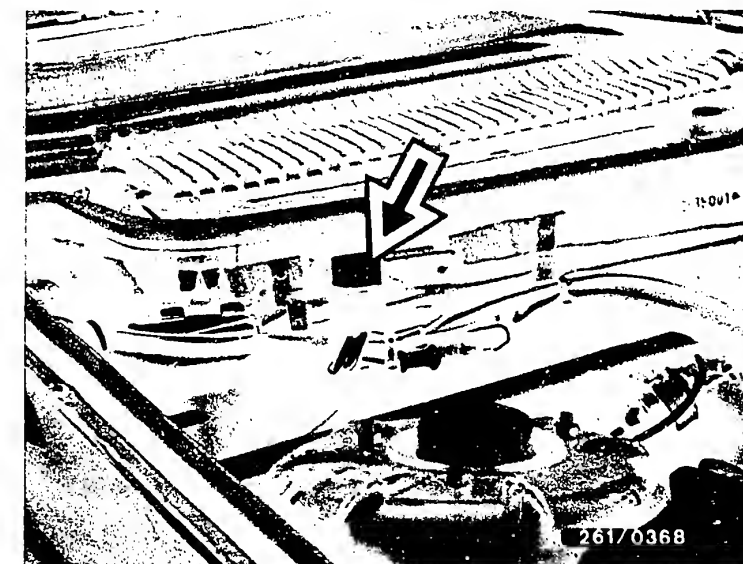


E14

Test with universal test adapter
BMW



TEST STEP 20:		
Operation	Reading	Testing
Program switch "V" in setting:	6	Component: Relay 2 (main relay)
Program switch "Ω" in setting:	15	
Test equipment:	<div> <div>yes</div> <div>↓</div> <div>Continue test- ing with <u>next</u> test step.</div> </div> <div>no</div>	Operation: Supply voltage for the control unit at terminals 35 (+) and 5 (ground)
Voltmeter		
Scale:		Malfunction: Voltage less than 10 V
15 V		
Connection:	V	
Test sockets (red = +, black = ground)		
Operation in vehicle: Switch ignition on		

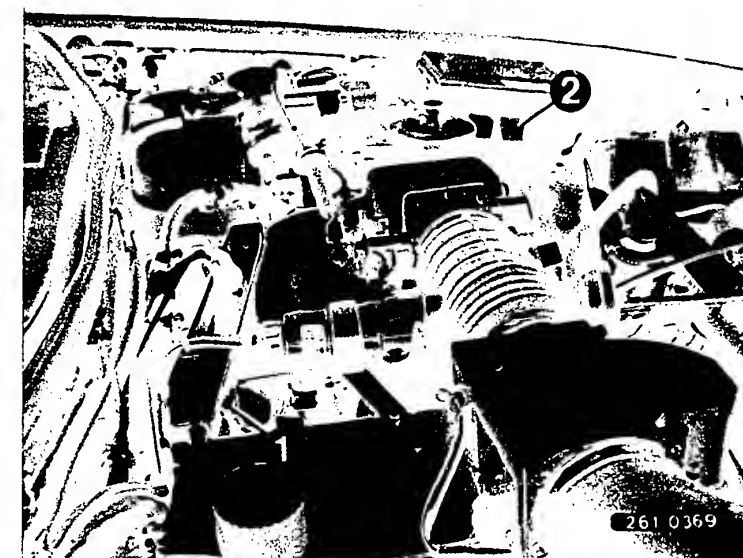


Arrow = Relay 2 (main relay)
(735i)

Note:

The arrangement of relays on the electrics box does not always correspond to that shown in the illustrations.

1 = Motronic ground terminal
2 = Relay 2 (main relay)
(535i and 635 CSi)



Trouble-shooting:

1. Voltage less than 10 V: Battery insufficiently charged, or high voltage drops at the terminal points.
2. No reading for voltage: Check relay 2. Take the following measurements for voltage at the relay with the ignition switched on:
 - Measure battery voltage at Term. 87 (2x), Term. 86. and Term. 30.
 - Measure the ground connection Term. 85 to B+ (test adapter connected).
 - Check the lead from relay 2 Term. 87 to the control unit plug Term. 35.
 - Check the Motronic ground terminal, and lead 5

Note: When taking out and replacing relay 2, be certain to install only a relay with a blocking diode! Watch the wiring symbol on the relay housing!

E15

Testing with universal test adapter
BMW

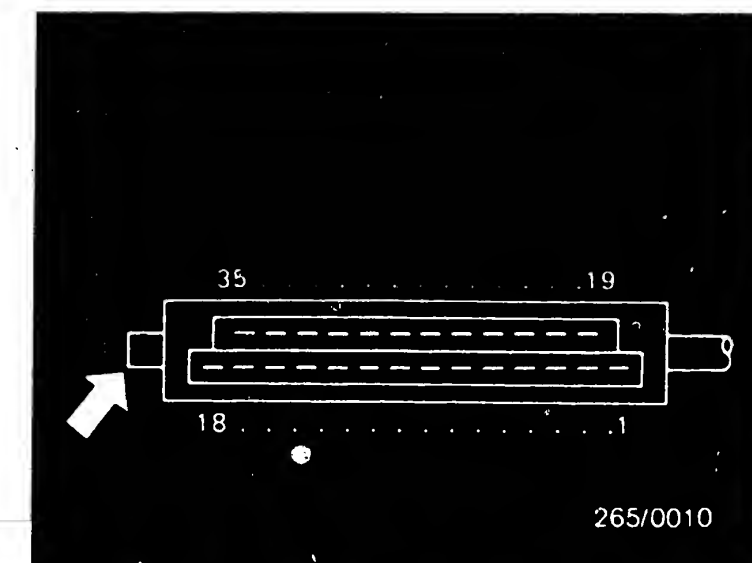


E16

Testing with universal test adapter
BMW



TEST STEP 21:			
Operation		Reading	Testing
<u>Program switch "V"</u> <u>in setting:</u>	7	Voltmeter must read <u>10 ... 15 V.</u>	<u>Component:</u> Permanent positive lead with fuse
<u>Program switch "Ω"</u> <u>in setting:</u>	15		
<u>Test equipment:</u> Voltmeter		<div>yes</div> <div>↓</div> <div>Continue test- ing with <u>next</u> test step.</div>	<u>Operation:</u> Supply voltage for control unit at terminals 18 (per- manent positive) and 5 (ground)
<u>Scale:</u> 15 V			
<u>Connections:</u> Test sockets (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Switch off ignition			
			<u>Malfunction:</u> Voltage less than 10 V



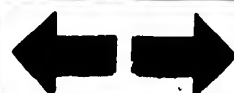
Top view of control-unit plug (35-pin) with terminal numbers. Arrow="Lug" with mechanical encoding

Trouble-shooting:

- Check lead from control unit plug term. 18 to B+ and appropriate fuse

E17

Testing with universal test adapter
BMW

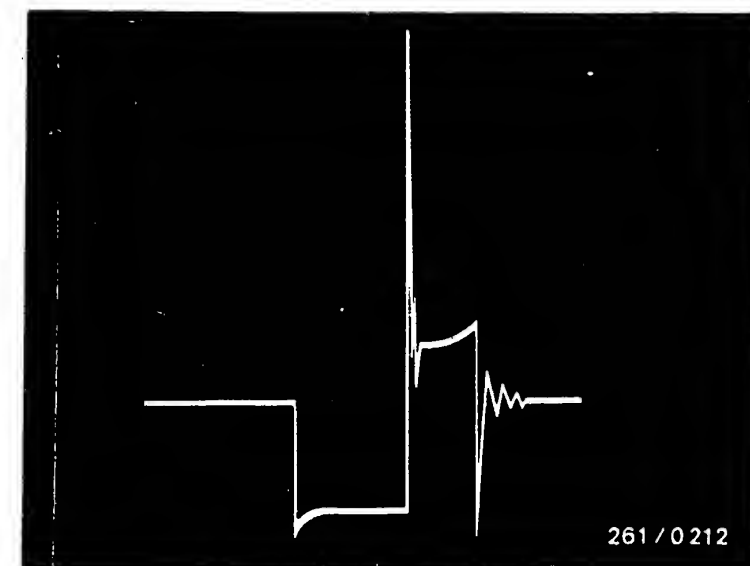


E18

Testing with universal test adapter
BMW

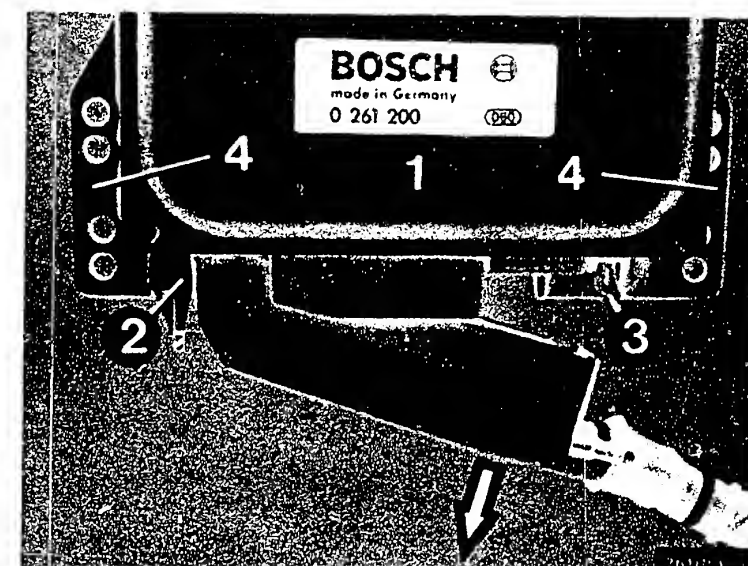


TEST STEP 22		
Operation	Reading	Testing
Program switch "V" in setting:	5	<u>Component:</u> Ignition coil, ignition leads. Control unit
Program switch "Ω" in setting:	15	
Test equipment: Motortester, oscilloscope		<u>Operation:</u> Primary signal from ignition coil Terminal 1 to ground
Scale: Special input		
Connection: Test wells. Red clip to red well, black clip to black well. Triggering at cylinder 1.	yes ↓ Continue test- ing with <u>next</u> test step.	<u>Malfunction:</u> No signal or incorrect signal
Operation in vehicle: Shift into neutral and start the engine	no ↓	



Primary signal

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes



Trouble-shooting:

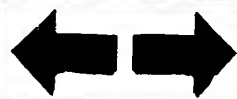
- Checking the Motronic ground terminal:
The terminal point must be bright and the screw must be tightened firmly.
- Check the ignition coil including the leads and the high voltage leads.
It must not be possible to shove back the spring contact on control unit plug Term. 1.
- Check the lead from ignition coil Term. 15 to the ignition lock Term. 15.
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

E19

Testing with universal test adapter
BMW

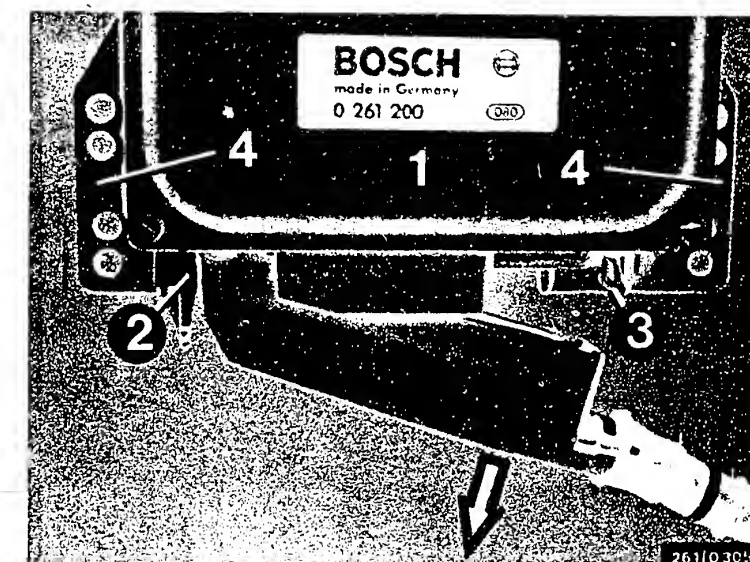


E20

Testing with universal test adapter
BMW



TEST STEP 23			
Operation		Reading	Testing
<u>Program switch "V" in position:</u>	8	Voltmeter must read <u>greater than 4,5 V</u>	<u>Component:</u> Control unit
<u>Program switch "Ω" in position:</u>	15		
<u>Test equipment:</u> Voltmeter		<div>yes</div> <div>↓</div> <div>Continue testing with <u>next test step</u></div> <div>no</div> <div>↓</div>	<u>Operation:</u> Supply voltage for air-flow sensor at Terminal 9 and ground.
<u>Scale:</u> 15 V			
<u>Connection:</u> Test sockets, (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Switch ignition on			
			<u>Malfunction:</u> Voltage less than 4,5 V.



- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting

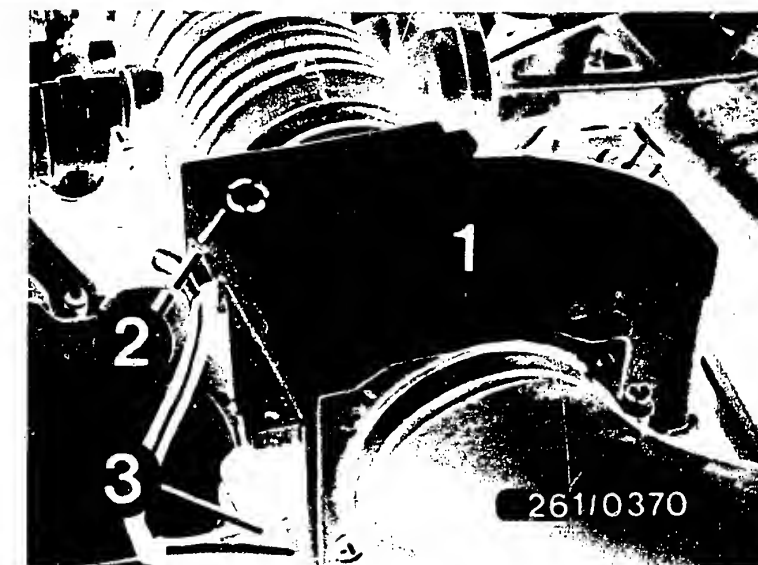
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

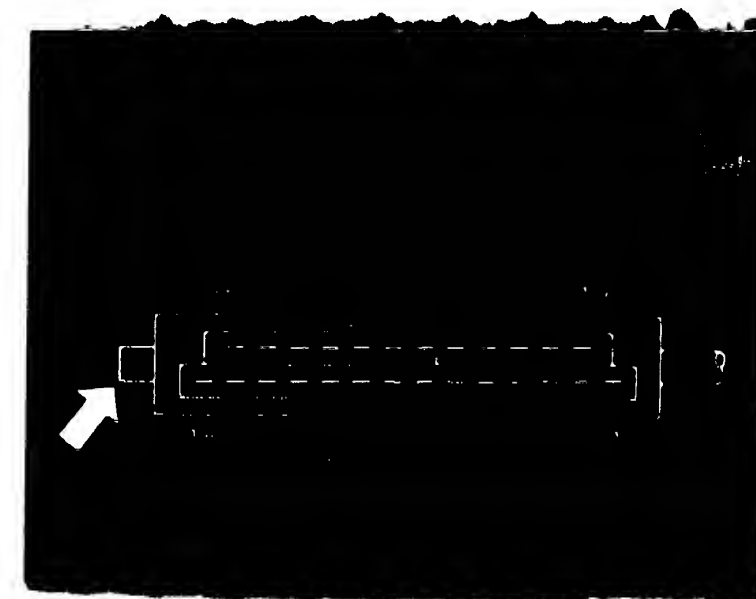


TEST STEP 24		
Operation	Reading	Testing
Program switch "V" in position:	9	<u>Component:</u> Air-flow sensor
Program switch "Ω" in position:	15	
Test equipment: Voltmeter	<div> <div>With the air-flow sensor flap closed, voltmeter must read: 200 ... 300 mV.</div> <div>Disconnect the hose from the air-flow sensor and open the air-flow sensor flap by hand. The sensor flap must not jam and must return to the at rest position by itself when released. When the air-flow sensor flap is fully open, reading rises to more than 4,5 V (switch over the measuring scale.)</div> <div> <div>yes</div> <div>no</div> </div> </div>	<u>Operation:</u> Divider voltage at Terminal 7 and ground
Scale: 1.5 V		<u>Malfunction:</u> No voltage or voltage less than 150 mV or greater than 250 mV
Connection: Test sockets (red = +, black = ground)	V	
Operation in vehicle: Ignition on	<div>Continue testing with test step 26. (skip test step 25).</div>	



- 1 = Air-flow sensor with NTC I
2 = Idle-mixture-adjusting screw
3 = Air-flow sensor plug

Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug", with mechanical coding



Trouble-shooting:

No reading:

- Check the lead from the air-flow sensor Term. 6, 7, and 9 to the control unit plug Term. 6, 7, and 9. (plug-in connection 3).
- It must not be possible to shove the spring contacts back.

If the reading is not within tolerance:

- Check whether air-flow sensor flap closes all the way
- Eliminate contact resistances in plug connection (3).
- Replace air-flow sensor.

E23

Testing with universal test adapter
BMW

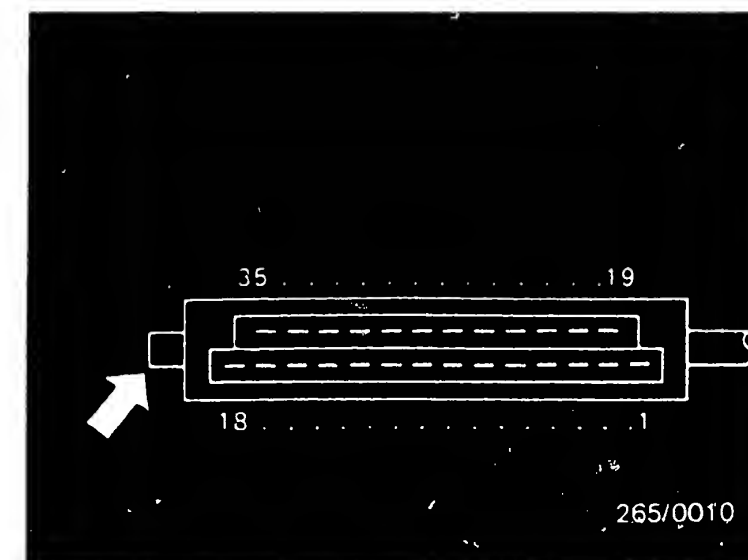


E24

Testing with universal test adapter
BMW



TEST STEP 26: (Skip test step 25)				
Operation		Reading		Testing
<u>Program switch</u> <u>"V" to position:</u>	11	With manual trans.: <u>approx. 0 V</u>		<u>Component:</u> Connection between term. 28 and ground, or, with automatic and electronic transmission control, the driving position switch.
<u>Program switch</u> <u>"Ω" to position:</u>	15	With automatic trans.: in position N, P: <u>approx. 0 V</u>		
<u>Measuring instrument:</u> Voltmeter		In position 1, 2, 3, D, R: <u>greater than 3.5 V</u>		
<u>Measuring range:</u> 15 V				<u>Operation:</u> Voltage at term. 28 to ground dependent on position of position switch.
<u>Connection:</u> Test sockets (red = +, black = ground)	V	-----		
<u>Operation in the vehicle:</u> Ignition on, engage driving positions		V		<u>Malfunction:</u> Manual transmission: <u>greater than 3.5 V</u> Automatic transmission: <u>voltage greater than 3.5 V</u> or <u>0 V</u> independent of drive position selected or outside of tolerance.
		yes		
		Continue testing with <u>next test step.</u>	no	
			V	



Top view of control unit plug
(35-pin) with terminal numbers.
Arrow = "Lug" with mechanical coding

Trouble-shooting:

For manual transmission connect term. 28 with ground.
With automatic and electronic transmission control, following
case distinction:

1.) Voltage at all switch positions approx. 0 V:

- Separate connection between term. 28 and ground
- Replace control unit (no voltage at term. 28).

2.) Voltage continuously greater than 3.5 V:

- o Connect term. 28 and driving position selector (e.g. plug connection)

3.) Voltage greater than 0 V and smaller than 3.5 V:

- Eliminate contact resistances (e.g. driving position selector, plug connections).
- Replace control unit (if voltage significantly below 3.5 V when measured directly at term. 28).

F1

Testing with the universal test adapter

BMW



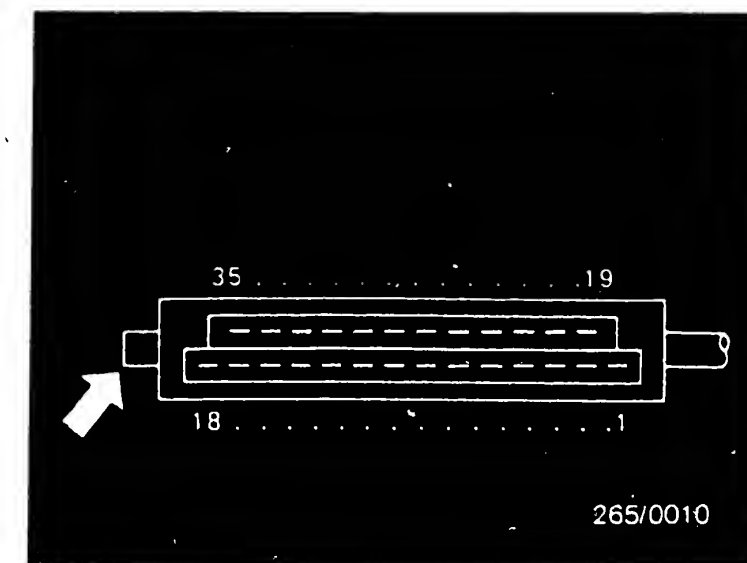
F2

Testing with the universal test adapter

BMW



TEST STEP 27:				
Operation		Reading	Testing	
Program switch "V" in setting:	12	During the starting process, the voltmeter must read <u>8 ... 15 V</u>	<u>Component:</u> Lead 4 from the starting motor Term. 50 to the control unit plug Term. 4	
Program switch "Ω" in setting:	15			
Test equipment. Voltmeter				
Scale 15 V		yes	no	
Connection: Test sockets (red = +, black = ground)	V	↓	↓	
Operation in vehicle: Shift into neutral and start the engine.		Continue test- ing with <u>next</u> test step.	↓	
			<u>Malfunction:</u> Voltage less than 8 V	



Top view of control unit plug (35-pole), with terminal numbers.
Arrow = "Lug", with mechanical coding

Trouble-shooting:

1. Voltage less than 8 V:

- Check the voltage at the starting motor Terminal 50.
- Check the lead from the control unit plug Terminal 4 to the starting motor Terminal 50.

F3

Testing with universal test adapter
BMW

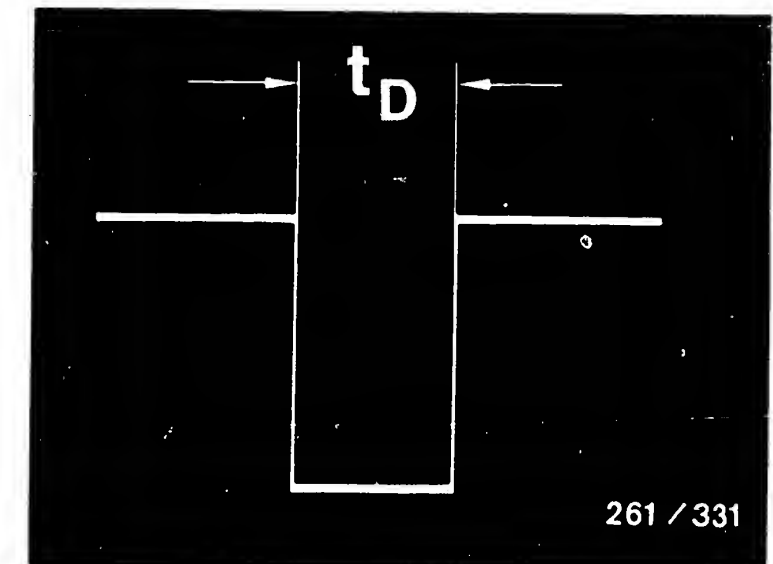


F4

Testing with universal test adapter
BMW



TEST STEP 28:		Reading	Testing
Operation			
Program switch "V" in setting	13	Dwell period signal (See Figure at top)	Component: Control unit
Program switch "Ω" in setting	15		
Test equipment: Motortester, oscilloscope		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div><div>no</div><div>↓</div></div>	Operation: Dwell period signal at Terminal 21 and ground
Scale: Special input			Malfunction: No signal
Connection: Test wells. Red clip to red well, black clip to black well.			
Operation in vehicle: Shift into neutral and start the engine.			



Dwell period signal
 t_D = Dwell period

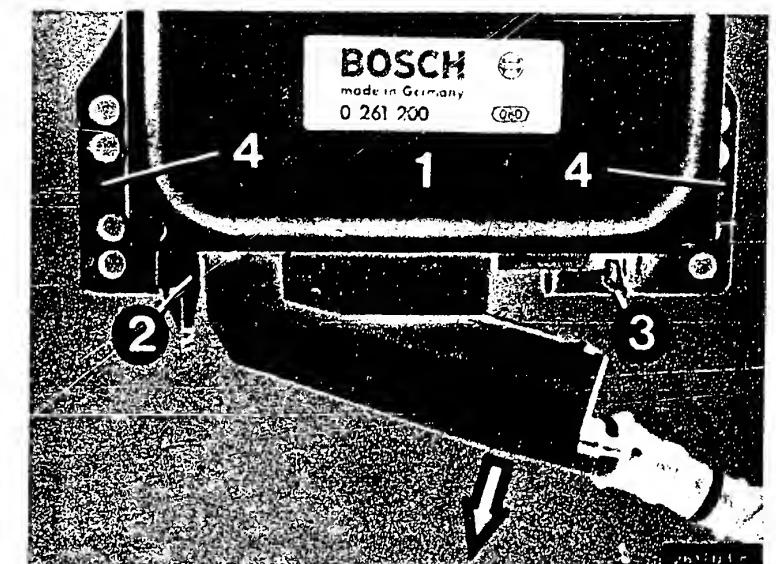
- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

- Take out and replace the control unit.

Note:

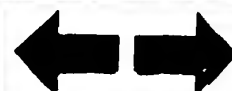
In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



F5

Testing with the universal test adapter

BMW



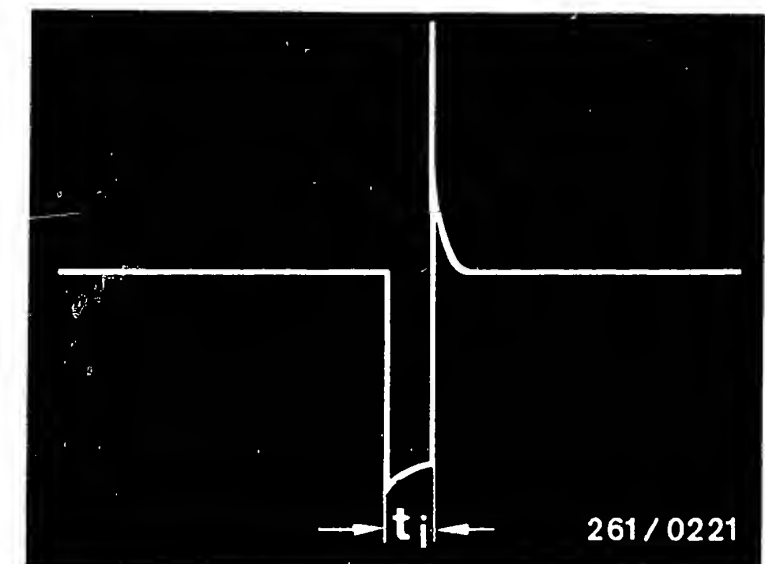
F6

Testing with the universal test adapter

BMW

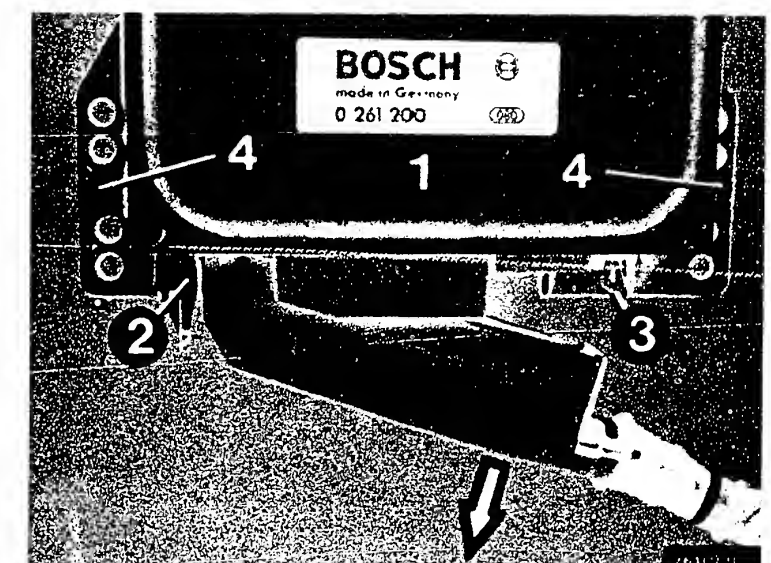


TEST STEP 29		Reading	Testing
Operation			
<u>Program switch "V" in setting:</u>	14	<u>Fuel-injection signal</u> (See Figure at top)	<u>Component:</u> Power supply for solenoid-operated fuel-injection valves, control unit
<u>Program switch "Ω" in setting:</u>	15		
<u>Test equipment:</u> Motortester, oscilloscope		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div><div>no</div><div>↓</div></div>	<u>Operation:</u> Fuel-injection output stage at Terminal 14 and ground
<u>Scale:</u> Special input			<u>Malfunction:</u> No signal
<u>Connection:</u> Test wells. Red clip to red well, black clip to black well.			
<u>Operation in vehicle:</u> Shift into neutral and start the engine.			



Fuel-injection signal
 t_i = Fuel injection period

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes



Trouble-shooting:

- Check the power supply for the solenoid-operated fuel-injection valves:
 Disconnect the connector from all the solenoid-operated fuel-injection valves. Measure the voltage at the two terminals on the valve connector. Battery voltage must be measured once at each valve connector. If there is no voltage present, check the lead from the valve connector to relay 2, Term. 87.
- Check the lead from the control unit plug Term. 14 to the solenoid-operated fuel-injection valves for Cylinders 1, 2, and 3.
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

F7

Testing with universal test adapter
 BMW



F8

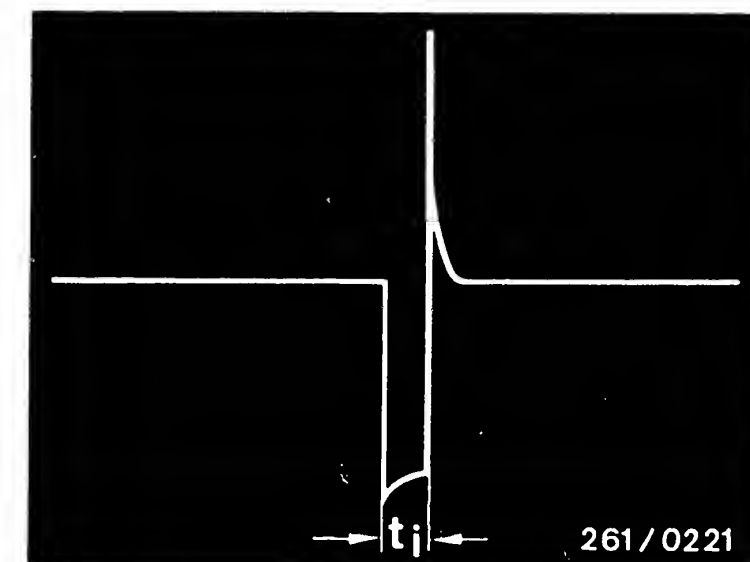
Testing with universal test adapter
 BMW



TEST STEP 30		Reading	Testing
Operation			
Program switch "V" in setting:	14	After button T1 (NTC II, cold) is pressed, the duration of injection t_i becomes somewhat longer!	Component: Control unit
Program switch "Ω" in setting:	15	Press T1 only briefly, or the engine will be supplied too richly.	
Test equipment: Motortester, oscilloscope			
Scale: Special input			Operation: Effect of temperature
Connection: Test wells. Red clip to red well, black clip to black well.		yes ↓ Continue testing with next test step.	
Operation in vehicle: Shift into neutral and start the engine		no ↓	Malfunction: The signal does not become wider when T1 is pressed.
Button: Press T1			

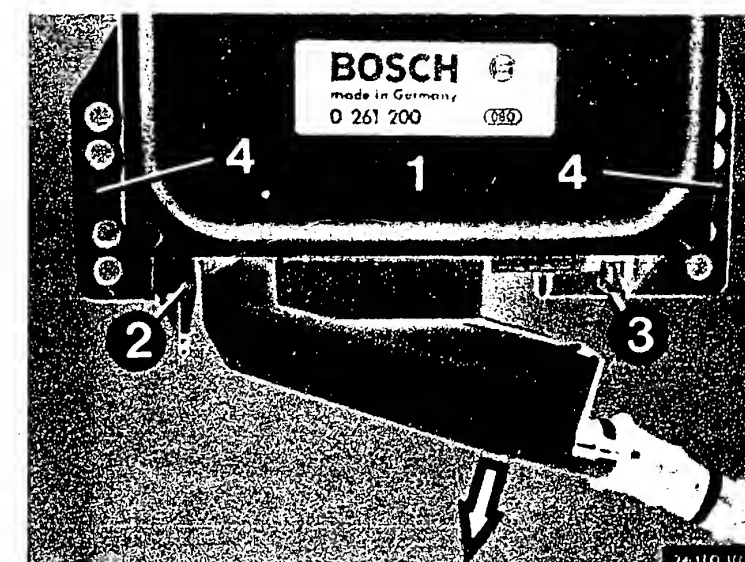
Take out and replace the control unit.

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

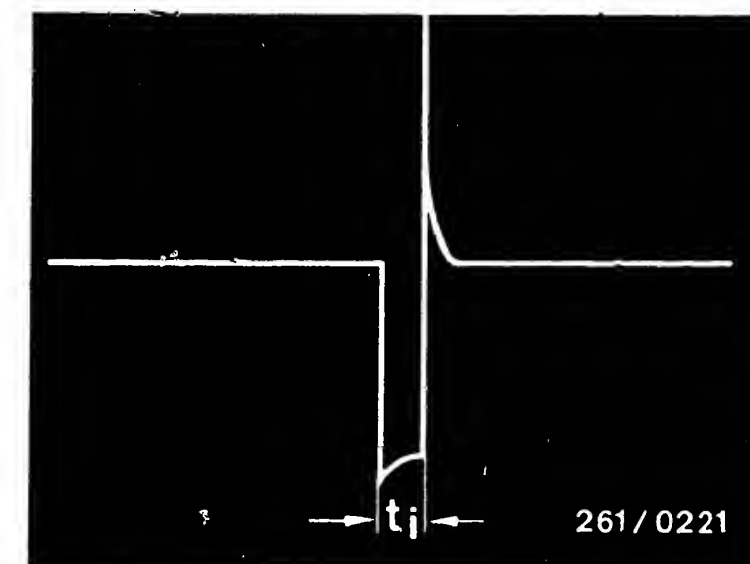


Fuel-injection signal
 t_j = Fuel-injection time

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes



TEST STEP 31		Reading	Testing
Operation			
Program switch "V" in setting:	15	Fuel-injection signal (See Figure at the top)	Component: Control unit
Program switch "Ω" in setting:	15		
Test equipment: Motortester, oscilloscope			
Scale: Special input		yes	Operation: Injection output stage at terminal 15 to ground
Connection: Test wells. Red clip to red well, black clip to black well.		no	Malfunction: No signal
Operation in vehicle: Shift into neutral and start the engine.		Continue test- ing with next test step.	



Fuel-injection signal
ti = Fuel-injection time

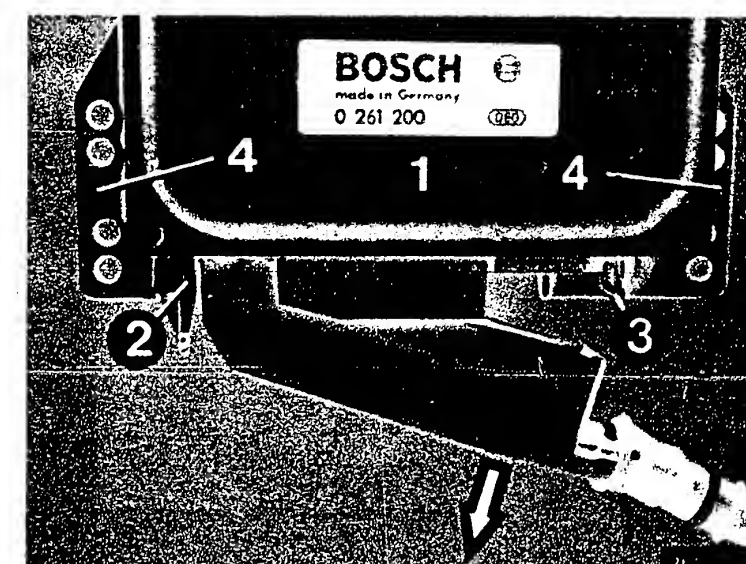
- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

- Check the power supply for the solenoid-operated fuel-injection valves. Disconnect the connectors from all the solenoid-operated fuel-injection valves. Measure the voltage at both terminals on the valve connector. Battery voltage must be measured once at each valve connector. If there is no voltage present, check the lead from the valve connector to relay to Term. 87.
- Check the lead from the control unit plug Term. 15 to the solenoid-operated fuel-injection valves for cylinders 4, 5, and 6.
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



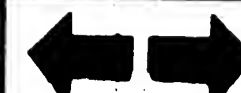
F11

Testing with the universal test adapter
BMW



F12

Testing with the universal test adapter
BMW



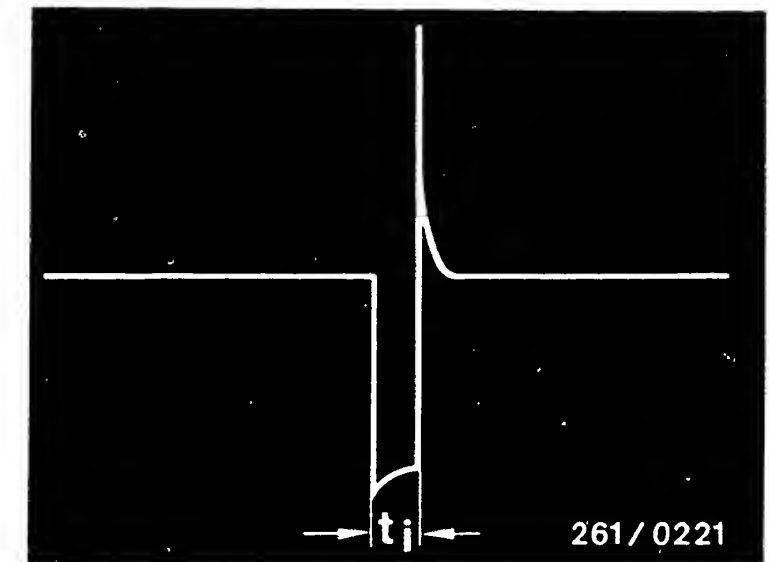
TEST STEP 32			
Operation		Reading	Testing
<u>Program switch "V"</u> <u>in setting:</u>	16	<u>Fuel-injection signal</u> (See Figure at top)	<u>Component:</u> Control unit
<u>Program switch "Q"</u> <u>in setting:</u>	15		
<u>Test equipment:</u> Motortester, oscilloscope		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div><div>no</div><div>↓</div></div>	<u>Operation:</u> Fuel-injection signal at Terminal 11 to ground
<u>Scale:</u> Special input			<u>Malfunction:</u> No signal
<u>Connection:</u> Tests wells. Red clip to red well, black clip to black well.			
<u>Operation in vehicle:</u> Shift into neutral and start the engine.			

Trouble-shooting:

Take out and replace the control unit.

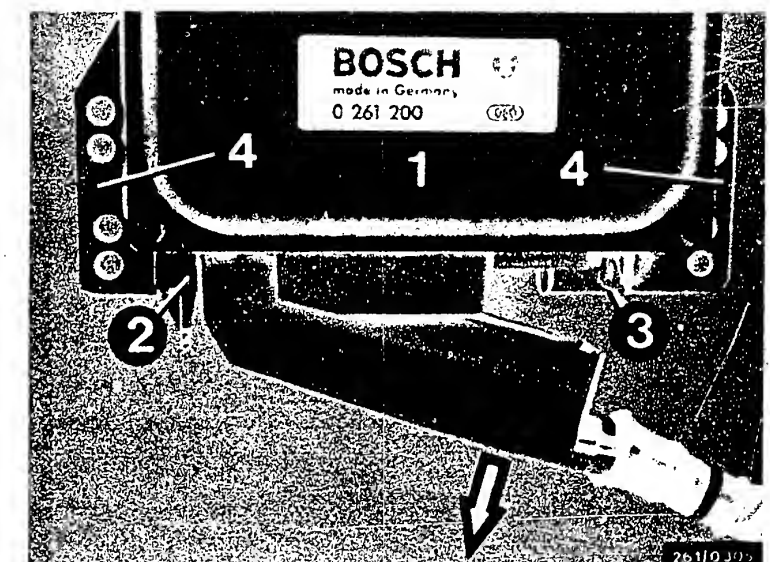
Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



Fuel-injection signal
 t_i = Fuel-injection time

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes



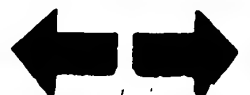
F13

Testing with the universal test adapter
BMW



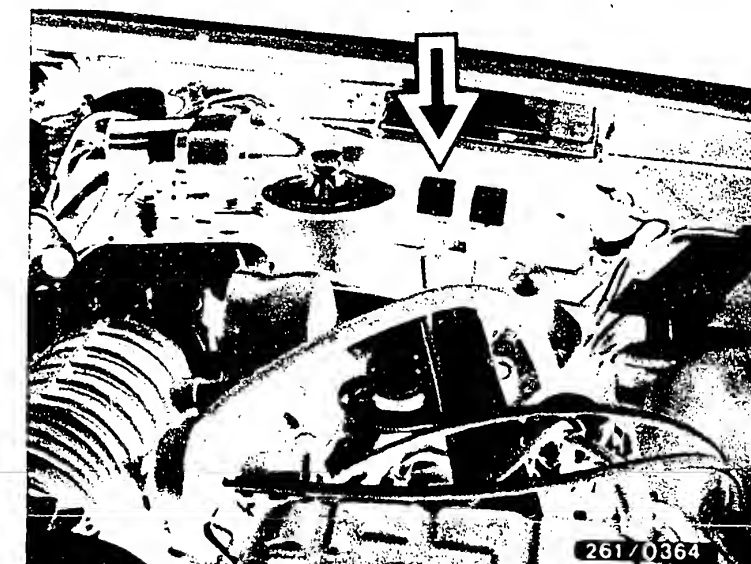
F14

Testing with the universal test adapter
BMW



TEST STEP 33: Plug in relay 1 (pump relay).

Operation		Reading	Testing
<u>Program switch "V"</u> <u>in setting:</u>	17	Voltmeter must read <u>10 ... 15 V</u>	<u>Component:</u> Relay 1 (pump relay)
<u>Program switch "Ω"</u> <u>in setting:</u>	15		
<u>Test equipment:</u> Voltmeter		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> test step.</div></div> <div>no</div> <div>↓</div>	<u>Operation:</u> Voltage at Term. 20 to ground
<u>Scale:</u> 15 V			<u>Malfunction:</u> Voltage less than 10 V
<u>Connection:</u> Test sockets; (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Switch ignition on			



Arrow = Relay 1 (pump relay)

Note:

Arrangement of relays on the electrics box does not always correspond to that shown in the illustrations.

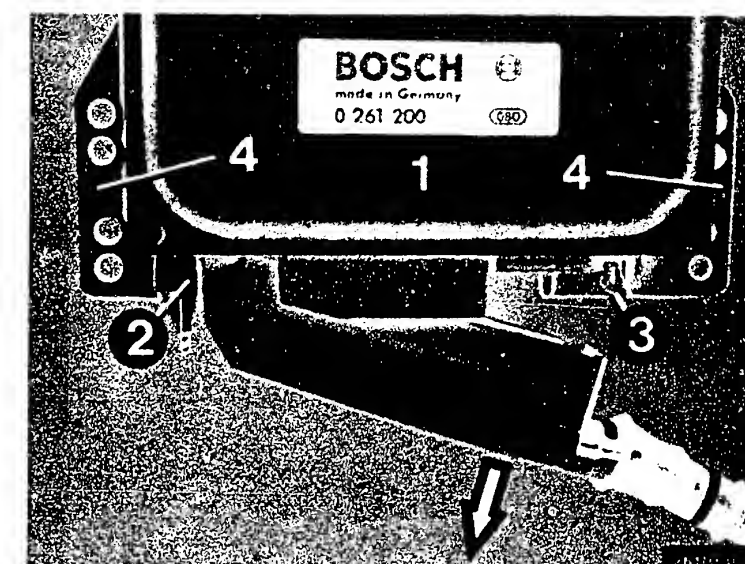
- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

- Take out and replace relay 1.
- Check the lead from control unit plug Term. 20 to relay 1 Term. 85.
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



F15

Testing with the universal test adapter
BMW

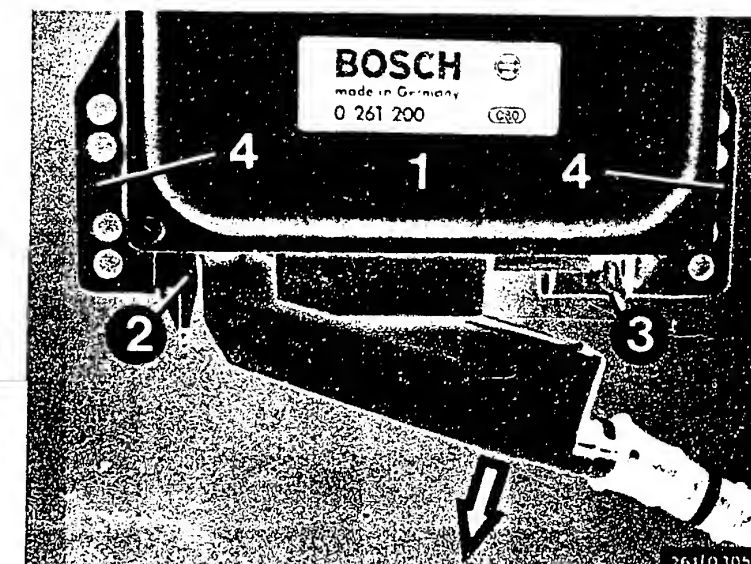


F16

Testing with the universal test adapter
BMW



TEST STEP 34:		
Operation	Reading	Testing
Program switch "V" in setting:	17	Component: Control unit
Program switch "Ω" in setting:	15	
Test equipment: Voltmeter	<div> <div>yes</div> <div>no</div> </div>	Operation: Pump control Term. 20 to ground
Scale: 15 V		
Connection: Test sockets; (red = +, black = ground)		Malfunction: Voltage greater than 4 V
Operation in vehicle: Shift into neutral and start the engine.	Continue test- ing with <u>next</u> test step.	



- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

F17

Testing with the universal test adapter
BMW



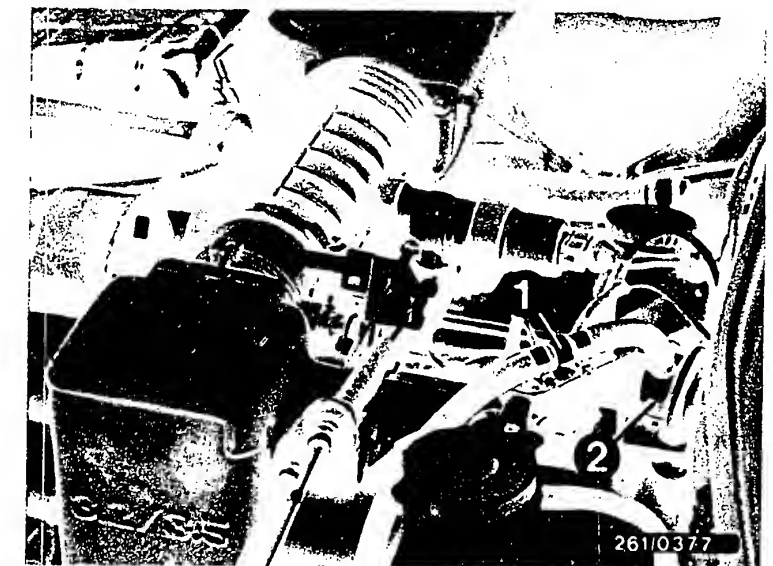
F18

Testing with the universal test adapter
BMW



TEST STEP 35 Switch ignition off, connect pressure guage.

<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch "V"</u> <u>in setting:</u>	17	<u>2.8 to 3.2 bar</u>	<u>Component:</u> Pump relay, fuel pump, pressure regulator, fuel filter
<u>Program switch "Ω"</u> <u>in setting:</u>	15		
<u>Test equipment:</u> Pressure gauge		<div><div>yes</div><div>↓</div><div>Continue test- ing with <u>next</u> <u>test step.</u></div></div> <div>no</div> <div>↓</div>	<u>Operation:</u> Fuel pressure
<u>Scale:</u> 0 to 6 bar			
<u>Connection:</u> In the fuel delivery line			
<u>Operation in vehicle:</u> Switch ignition on			
<u>Button:</u> Press T3			
			<u>Malfunction:</u> No fuel pressure or pressure not within tolerance

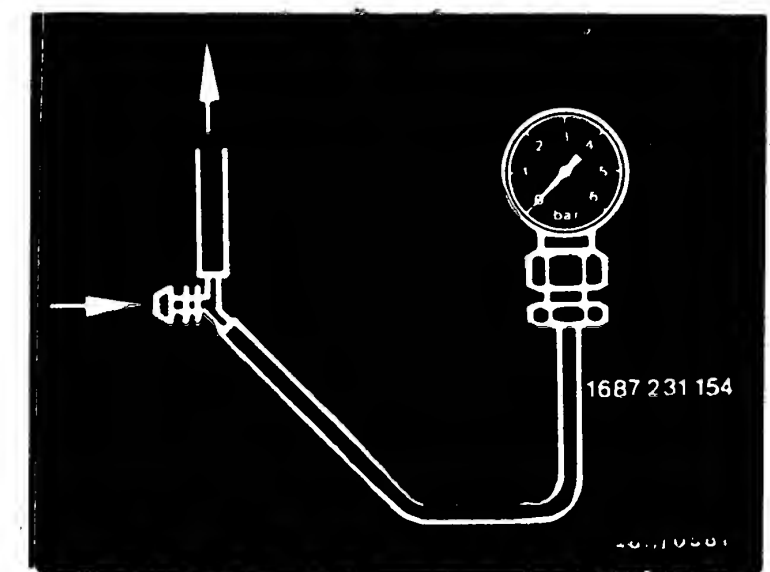


- 1 = Connection for pressure gauge
- 2 = Fuel-line-pressure damper in fuel-pressure line

Note:

Install pressure gauge in fuel-pressure line (1).
Catch any gasoline that runs out! Fire hazard with hot engine and electrical sparks.

Continued on F21/F22



F19

Testing with the universal test adapter

BMW



F20

Testing with the universal test adapter

BMW



Trouble-shooting, TEST STEP 35 (continued)

- Disconnect pump plug and measure voltage on it.

If there is no voltage present:

Check the lead from the fuel pump to relay 2 Term. 87b and the pump ground lead.

- If there is voltage present:

Check the pressure regulator and the fuel pump as described below in section 2.

2. Fuel pressure less than 2.8 bar, fuel pump is running:

- Fuel pressure too low:

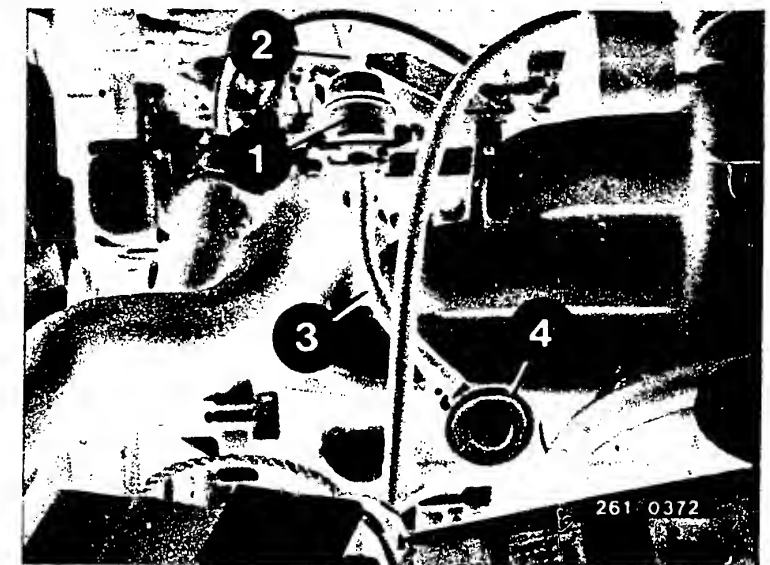
Slowly pinch off the return line with a pinching clamp. If the pressure rises above 4 bar, take out and replace the pressure regulator.

If the pressure remains less than 4 bar, take out and replace the fuel pump.

- Check the fuel line and filter for open passage. Are the fuel lines pinched off?
- Is the tank filter clogged?
- Is there corrosion in the tank?

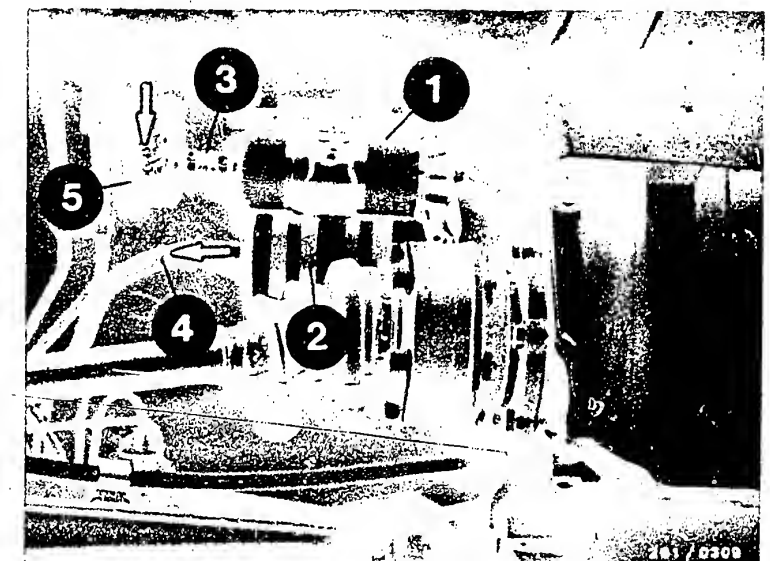
3. Fuel pressure greater than 3.2 bar:

- Fuel return line is clogged or pinched off.
- Take out and replace the pressure regulator.
The fuel pressure regulator is fastened to the fuel distribution pipe using two fastening screws and across an O-ring.
After the pressure regulator is take out, the O-ring and the flat ring must be replaced. (Use set of parts 1 287 010 704)



- 1 = Pressure regulator
- 2 = Air hose to intake manifold
- 3 = Fuel-return hose
- 4 = Fuel-line-pressure damper

- 1 = Electric fuel pump
 - 2 = Fuel filter
 - 3 = Fuel intake line
 - 4 = Fuel delivery line
 - 5 = Fuel spinner
- Arrow = Direction of flow



F23

Testing with universal test adapter
BMW



F24

Testing with universal test adapter
BMW



N.B.!

The following test steps can be run only with the engine running. If the engine does not run, continue according to the trouble-shooting plan you have selected.

Detailed trouble-shooting, see C3-C4

Targeted trouble-shooting, see C5-C10.

Connect motortester, diagnosis lead, and CO tester before catalytic converter. If necessary, use BMW exhaust probe 130 090 with adapter 130 100.

TEST STEP 36 When using adapter lead 1 684 463 124, remove plug connection from lambda sensor to CO measurement (open-loop control).

Operation	Reading	Testing
<u>Program switch "V"</u> in setting:	17	<u>Component:</u> Idle actuator, air-flow sensor, engine, intake system leakage, control unit.
<u>Program switch "Ω"</u> in setting:	15	
<u>Test equipment:</u> Motortester and CO-tester	<u>1. Idle speed:</u> 750 ... 850 min ⁻¹ <u>CO value:</u> 0.2...1.2 vol. % CO <u>2. Press button T2:</u> values must not change!	<u>Operation:</u> Idle speed and exhaust gas
<u>Scale:</u> Engine speed and CO		
<u>Connection:</u> Ignition coil, exhaust		<u>Malfunction:</u> Values not within tolerance
<u>Operation in vehicle:</u> Let engine run to operating temperature. Disconnect loads.		

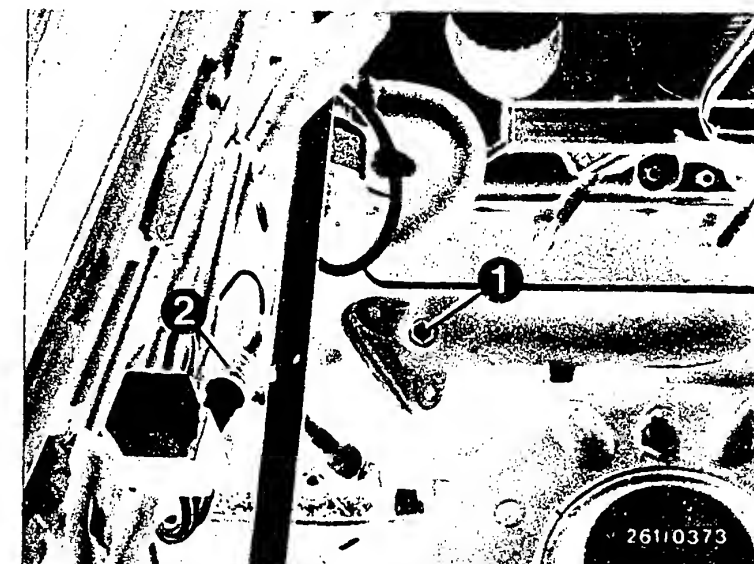
Trouble-shooting:

- Idle speed cannot be adjusted.

Idle actuator defective.

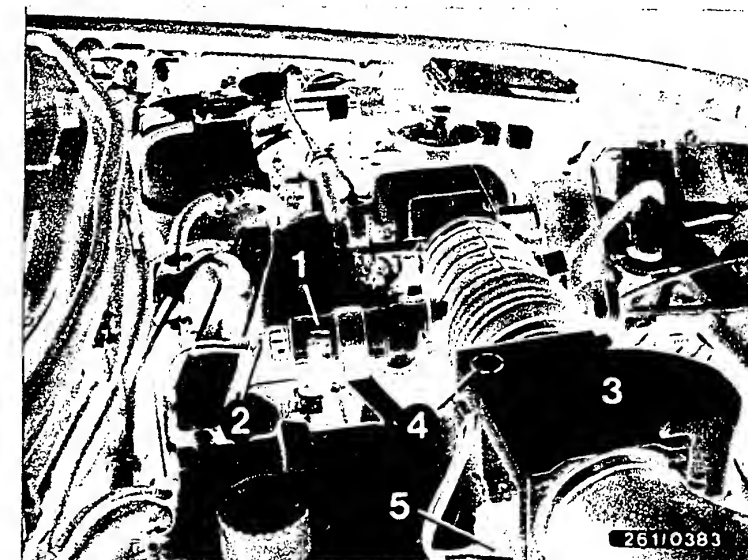
Measure winding resistance of idle actuator. In case of interruption or 0 Ω, actuator is defective.

Continued on G3/G4



- 1 = CO connection before cat. converter (cyl. 4, 5, 6)
- 2 = Plug connection from lambda sensor

- 1 = Idle actuator
- 2 = Actuator plug
- 3 = Air-flow sensor with NTC I
- 4 = Idle-mixture-adjusting screw
- 5 = Air-flow sensor plug



G1

Testing with the universal test adapter

BMW



G2

Testing with the universal test adapter

BMW



Trouble-shooting - TEST STEP 36 (continued)

- Measure pulses at idle actuator. At idle speed the image to the right should be visible on the oscilloscope.
If no pulses present: check voltage supply to idle actuator, then inspect leads to control unit (term. 3, 34). If necessary, replace control unit.
Further trouble-shooting: actuator mechanically defective, e.g. rotary spool not freely moveable.
- Adjust exhaust gas with idle-mixture-adjusting screw (hexagon socket SW 5) in air-flow sensor.
To do this, remove vent plugs in air-flow sensor with special tool. After adjustment is completed, insert new vent plugs (red).

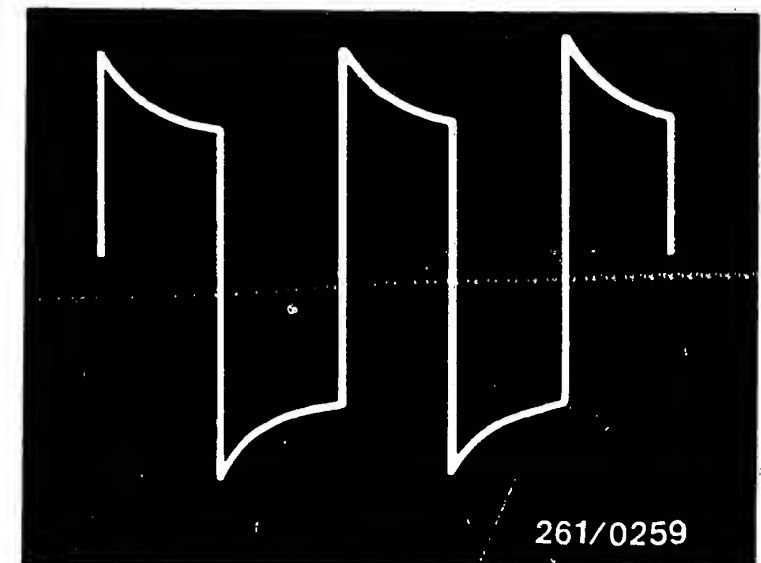
Turn idle-mixture-adjustment screw to the right: CO value becomes larger.

Turn idle-mixture-adjusting screw to the left: CO value becomes smaller.

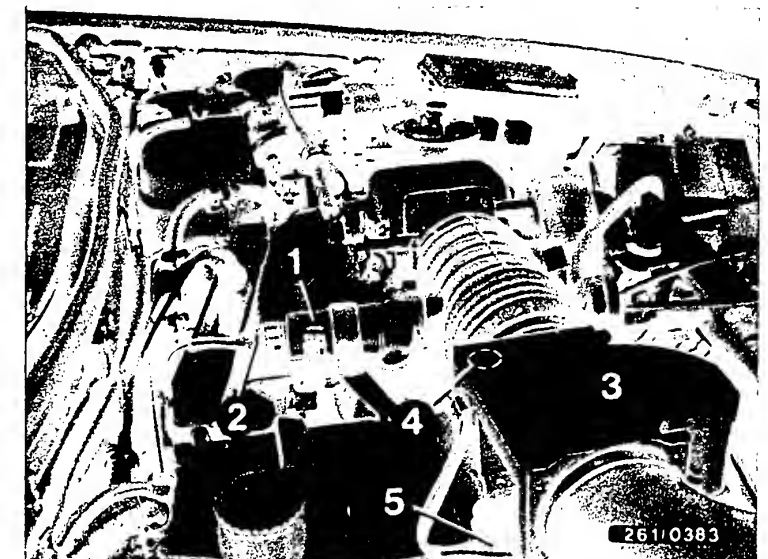
Exhaust-gas value smaller than 0.2 vol. % CO and no longer adjustable:
Check intake side and exhaust system for leakage by pressing (in particular, connecting piece between intake manifold and air-flow sensor).

Re 2.

If values change after pressing button T2, the engine is not yet at operating temperature.



- 1 = Idle actuator
- 2 = Actuator plug
- 3 = Air-flow sensor with NTC I
- 4 = Idle-mixture-adjusting screw
- 5 = Air-flow sensor plug



G3

Testing with the universal test adapter
BMW



G4

Testing with the universal test adapter
BMW

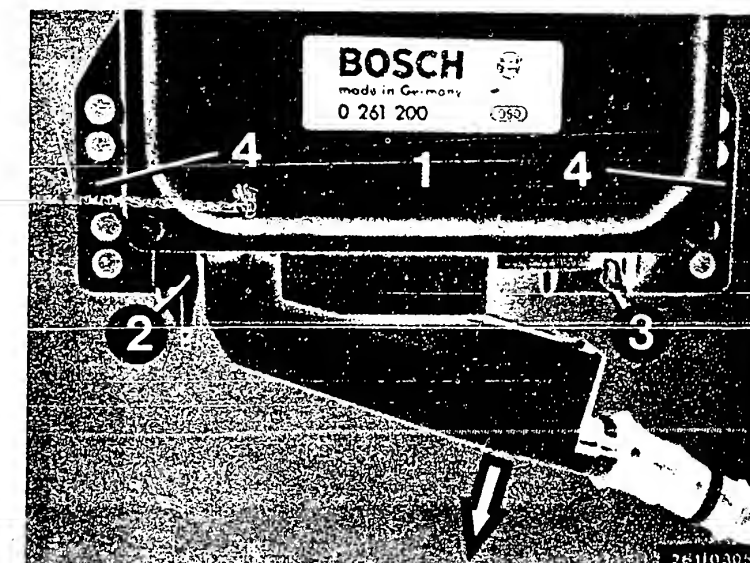


TEST STEP 37 Transmission control unit (if present) disconnected or 13-pin plug (glove compartment area) pulled.		
Operation		Reading
Program switch "V" in setting:	17	1. With engine at normal operating temperature and idle speed: 8° ... 18°
Program switch "Ω" in setting:	15	Note: If the idle speed fluctuates, the timing angle also fluctuates.
Test equipment: Motortester		2. Press button T6 (full load) and increase engine speed to 2500 min ⁻¹ .
Scale: Timing angle		At intake-air temperature below approx. 25°C: Spark advance 23°...33°
Connection: Diagnosis cable		At intake-air temperature greater than approx. 45°C: Spark advance 14°...24°
Operation in vehicle: Have engine run at normal operating temperature		

Component:
Control unit

Operation:
Timing angle at idle and full load

Malfunction:
Timing angle not within tolerance



- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

- For 1: recheck the idle speed exactly, and repeat the test step. The idle speed must be between 750 and 850 min⁻¹ or the readings for timing angle will be different!
- For 2: Run up the engine speed again and take another reading for timing angle. Switch the auxiliary fan on!
- Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

G5

Testing with universal test adapter
BMW

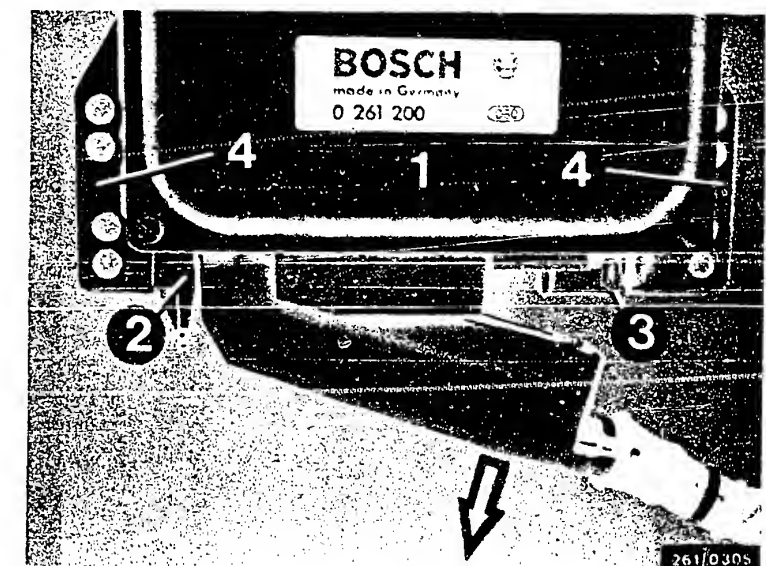


G6

Testing with universal test adapter
BMW



TEST STEP 38			
Operation		Reading	Testing
Program switch "V" in setting:	17	1. With engine at normal operating temperature and at idle speed: 6° ... 18° 2. At 3000 min ⁻¹ 15° ... 35°	Component: Control unit
Program switch "Ω" in setting:	15		
Test equipment: Motortester			Operation: Dwell angle
Scale: Dwell angle		yes	
Connection: Ignition coil		Continue test- ing with <u>next</u> test step.	Malfunction: Dwell angle not within tolerance
Operation in vehicle: Have engine run			
		no	



- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

G7

Testing with universal test adapter
BMW

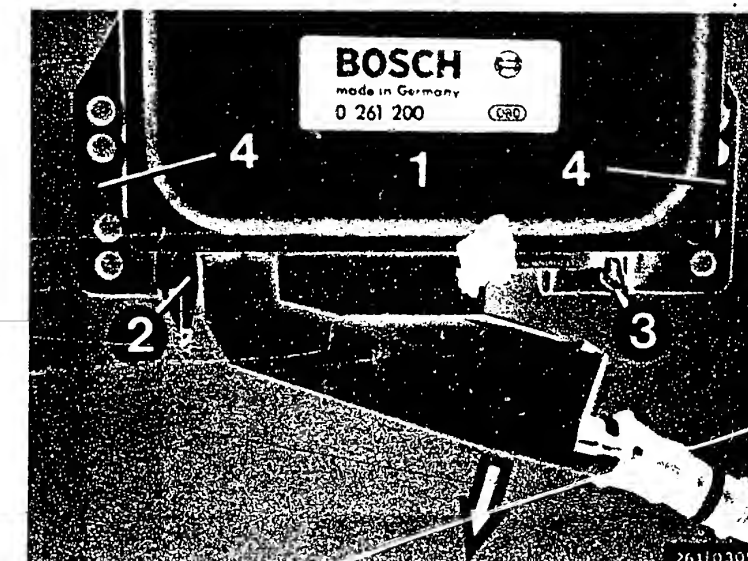


G8

Testing with universal test adapter
BMW



TEST STEP 39		
Operation		Reading
Program switch "V" in setting:	17	Engine at normal operating temperature. Engine speed 2000 min-1. (Keep the same setting for the accelerator pedal.) Press button T5: <u>Engine "hunts,"</u> i.e., engine speed drops off and then increases again. (Fuel-injection signal disappear and then reappear at approx. 1000 ... 1200 min-1.) The fluctuations in engine speed remain as long as <u>button T5 is pressed.</u>
Program switch "Ω" in setting:	15	
Test equipment: Motortester		
Scale: Engine speed		<div>yes</div> <div>no</div> <div>Continue testing with <u>next test step.</u></div>
Connection: Ignition coil		
Operation in vehicle: Have engine run		
Button: Press T5		
		<div>Component:</div> <div>Control unit</div> <div>Operation:</div> <div>Cutoff of the fuel-injection signals (overrun cutoff)</div> <div>Malfunction:</div> <div>No cutoff</div>



- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

G9

Testing with universal test adapter
BMW



G10

Testing with universal test adapter
BMW



TEST STEP 40 Transmission control unit (if present) disconnected or 13-pin plug (glove compartment area) unplugged		
Operation	Reading	Testing
Program switch - setting "V"	18	Components: Control unit, idle actuator
Program switch - setting "Ω"	15	
Test equipment: Motortester, pocket-tester	56% \pm 5% Measure with engine at operating temperature and idle and full-load contact closed (buttons T5, T6 simultaneously pressed) as well as with all loads off.	Function: On/off ratio of the idle speed control between Term. 33 and Term. 5
Range of measurement: Oscilloscope, dwell angle		Malfunction: 1. No signal 2. On/off ratio deviates considerably
Connection: Test wells; red clip to red well, black clip to black well	The idle speed must then be 750...800 min ⁻¹ ; if not, it must be corrected at throttle-valve stop and the throttle-valve switch subsequently reset.	
Operation in the vehicle: Have the engine run		

Trouble-shooting:

- Measure the internal resistance in the idle actuator:
 Term. 2 to Term. 3: 17 ... 22.5 Ω (at +15°...+30°C):
 Term. 2 to Term. 1: 19 ... 25 Ω (at +15°...+30°C):
 When taking out and replacing the idle actuator, watch the direction of flow through it (arrow).
- Take out and replace the control unit.

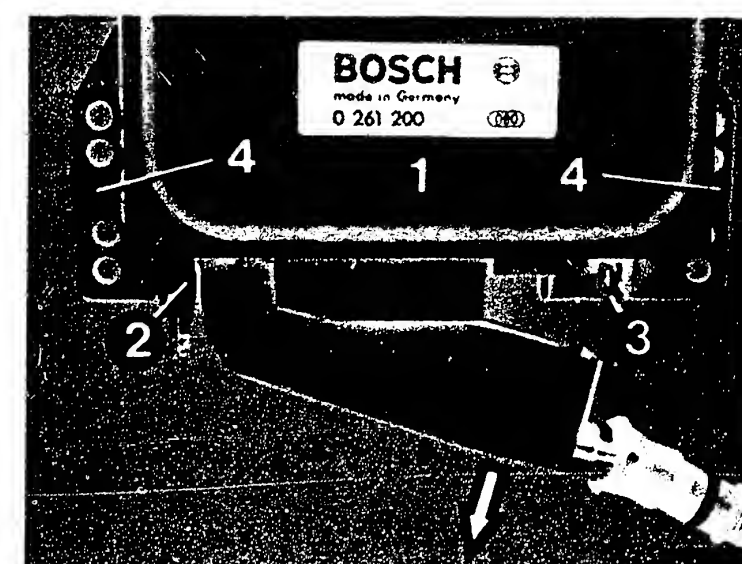
Note:

In order to rule out any confusion between the control units of the various systems, a mechanical locking device has been introduced. The "locating lug" (pivot point when opening and connecting the control unit) and the corresponding mounting point on the control unit have matching recesses and pins.



Signals at idle actuator

- 1 = Control unit
- 2 = Plug lug
- 3 = Plug lock
- 4 = Fastening holes



G11

Testing with the universal test adapter

BMW



G12

Testing with the universal test adapter

BMW



TEST STEP 41		
Operation	Reading	Testing
Program switch - setting "V"	19	Components: Control unit, idle actuator
Program switch - setting "Ω"	15	
Test equipment: Motortester, pocket-tester	1. Signals present (see figure at top) 2. On/off ratio (dwell angle) with pocket- tester $44\% \pm 5\%$ Measure under same conditions as in test step 40	Function: On/off ratio of the idle speed control between Term. 34 and Term. 5
Range of measurement: Oscilloscope, dwell angle		
Connection: Test wells; red clip to red well, black clip to black well		Malfunction: 1. No signal 2. On/off ratio deviates considerably
Operation in the vehicle: Have the engine run		

Trouble-shooting:

- Measure the internal resistance in the idle actuator:
Term. 2 to Term. 3: $17 \dots 22.5 \Omega$ (at $+15^\circ \dots +30^\circ \text{C}$):
Term. 2 to Term. 1: $19 \dots 25 \Omega$ (at $+15^\circ \dots +30^\circ \text{C}$):
When taking out and replacing the idle actuator, watch the
direction of flow through it (arrow).
- Take out and replace the control unit.

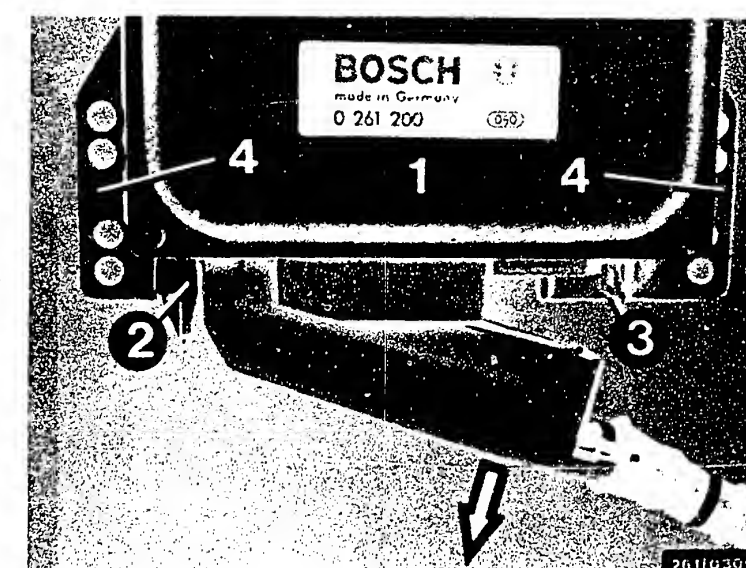
Note:

In order to rule out any confusion between the control units of the various systems, a mechanical locking device has been introduced. The "locating lug" (pivot point when opening and connecting the control unit) and the corresponding mounting point on the control unit have matching recesses and pins.



Signals at idle actuator

- 1 = Control unit
- 2 = Plug lug
- 3 = Plug lock
- 4 = Fastening holes



G 13

Testing with the universal test adapter
BMW

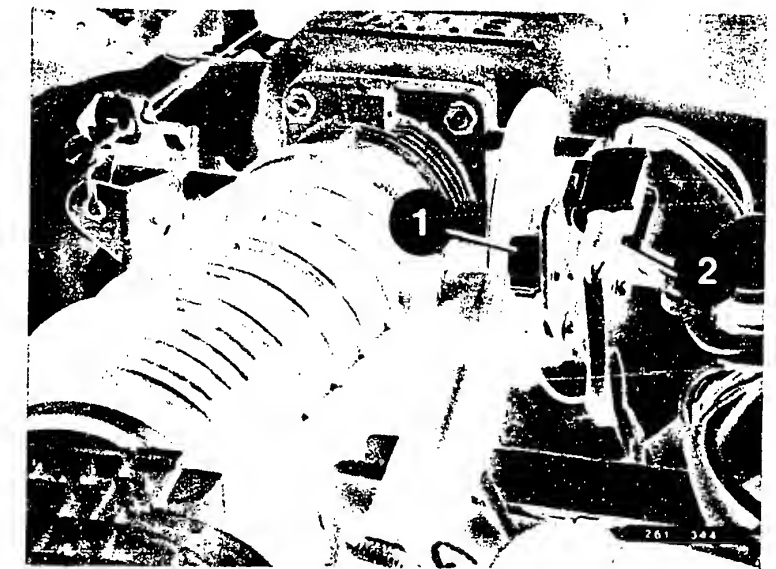


G 14

Testing with the universal test adapter
BMW



TEST STEP 42 (only for vehicles with electronic transmission control)					
Connect transmission control unit!					
Operation		Reading		Testing	
Program switch "V" to position:		↓	Do not depress accelerator pedal; briefly start in order to initialize transmission control unit, then do not switch off ignition, and read off voltage: greater than 2 V Accelerator pedal at full-load position: smaller than 1 V		Component: Transmission control unit, throttle-valve potentiometer
Program switch "Ω" to position:					
Measuring instrument: Voltmeter		10	Operation: Full-load enrichment (term. 3) via transmission control unit term. 31.		
Measuring range: 15 V (Voltage measurement at Ω)					
Connection: Test sockets					
Operation in the vehicle: Switch on ignition		yes ↓ V Continue testing with next test step.	no ↓ V	Malfunction: 1. Voltage at full-load greater than 1 V. 2. Voltage in idle smaller than 2 V.	



Vehicles with electronic transmission control

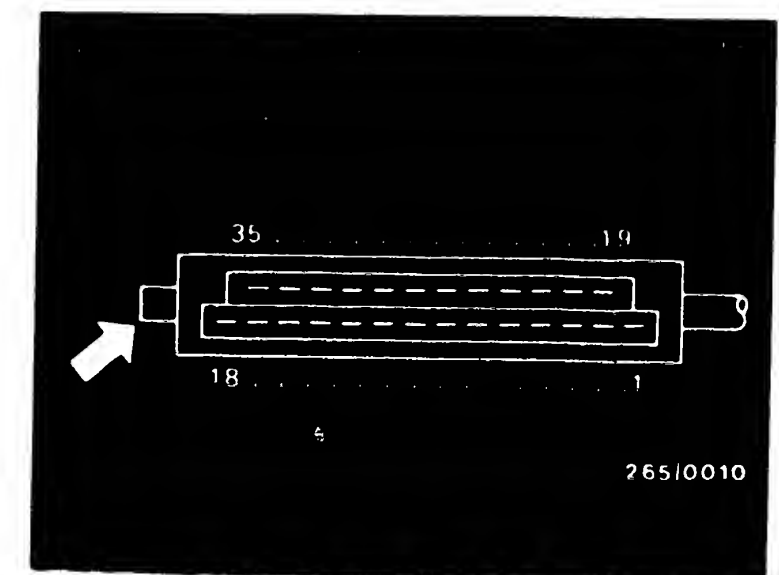
- 1 = Microswitch (idle contact)
2 = Potentiometer (no full-load contact) (1 and 2 under a rubber cap)

Top view of control unit plug (35-pin).

Arrow = "Lug" with mechanical coding

Trouble-shooting:

- Re 1: ● Is there connection between Motronic control unit (term. 3) and transmission control unit (term. 31) (e.g. 13-pin plug)?
● Check whether throttle valve is completely open. Check bowden cable from accelerator pedal to throttle valve.
● Further trouble-shooting in transmission control.
- Re 2: Separate 13-pin plug in glove compartment area; if there is no change, Motronic control unit is defective; otherwise the fault lies with transmission control.



G 15

Testing with the universal test adapter
BMW



G 16

Testing with the universal test adapter
BMW



Testing of the lambda sensor (following test steps) can be carried out as follows:

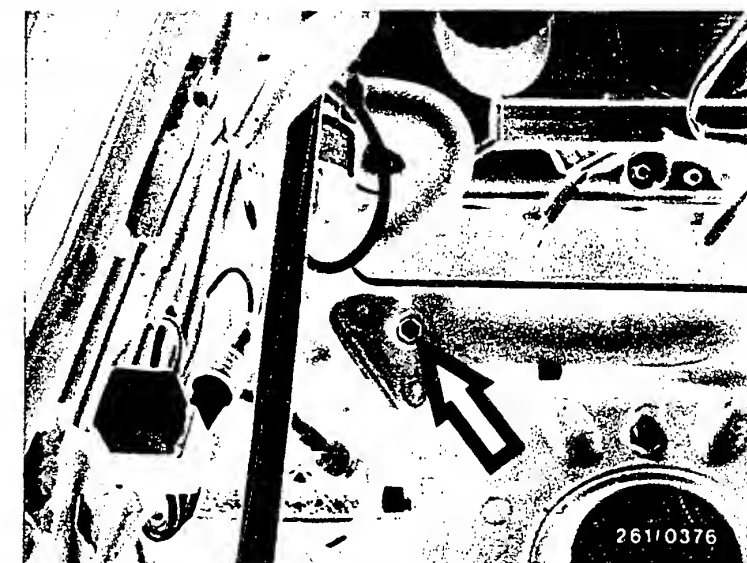
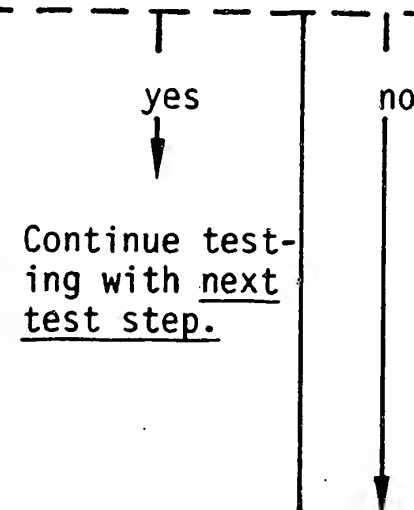
1. With adapter lead 1 684 463 128
(Test steps 43, 44, 45)
2. Without test adapter, if only adapter lead 1 684 463 124 is available for testing the Motronic.
(Test steps 43a, 44a, 45a)

Connect CO tester before catalytic converter with both test methods (if necessary, use BMW exhaust probe 130 090 with adapter 130 100) and operate engine in idle at operating temperature.



TEST STEP 43 Testing with adapter lead 1 684 463 128

Operation		Reading	Testing
Program switch "V" in setting:	20	CO rises above 1.2 vol. % For the sake of the cat. converter, carry out this test step only briefly	Component: Control unit
Program switch "Ω" in setting:	22		Function: Lambda closed-loop control, upper limit of closed-loop control ("rich" stop). Test lead connects term. 24 of control to ground.
Test equipment: CO-tester			
Scale: 10 vol. %		<div>yes</div> <div>no</div>	Malfunction: CO unchanged
Connection: On the test fixture			
Operation in vehicle: Let engine run (operating temperature).			



Arrow = CO connection before
catalytic converter (cyl.
4, 5, 6)

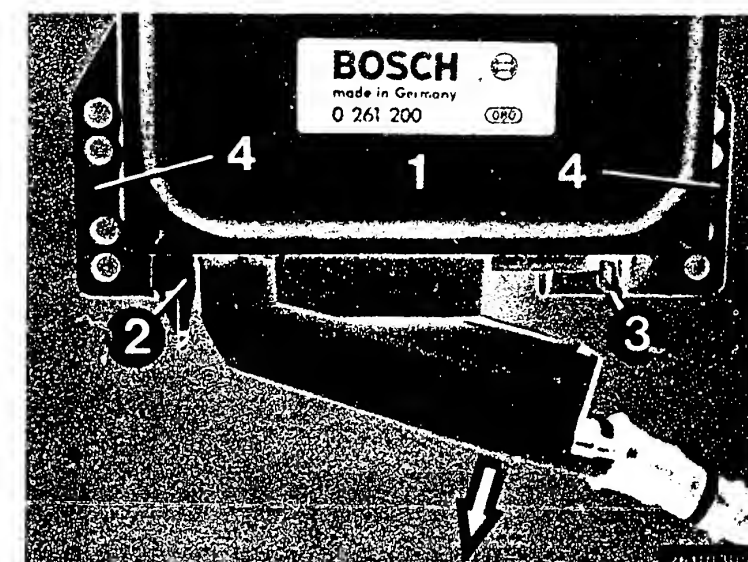
- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes

Trouble-shooting:

Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.



G18

Testing with the universal test adapter
BMW

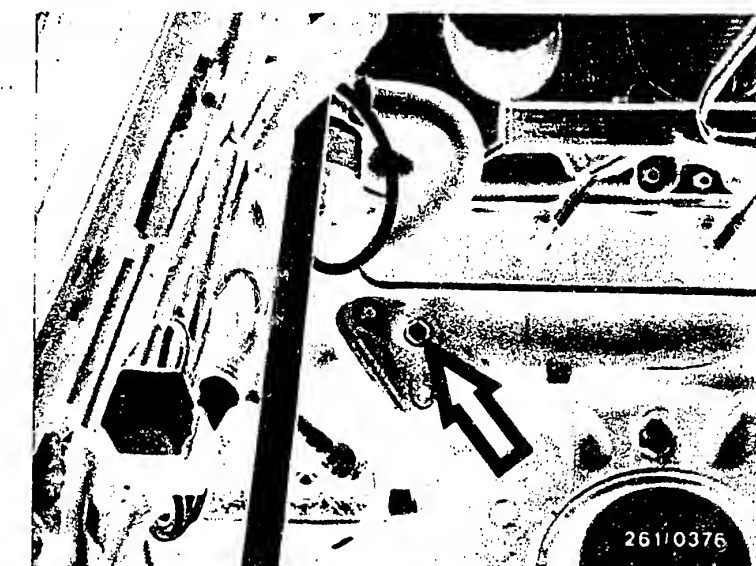


G19

Testing with the universal test adapter
BMW

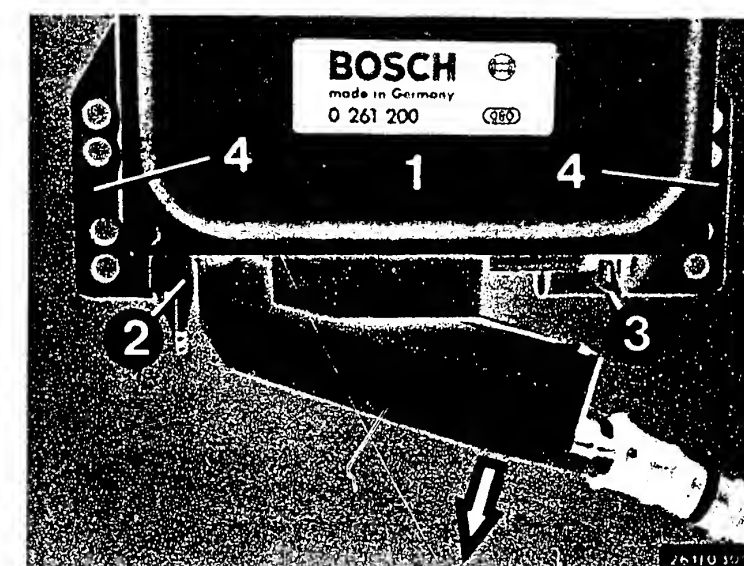


TEST STEP 44			
Operation		Reading	Testing
Program switch "V" in setting:	20	CO drops below 0.2 vol. %.	Component: Control unit
Program switch "Ω" in setting:	23	Engine runs rough. After approx. 10 sec., CO-level rises again.	
Test equipment: Co-tester		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> yes ↓ Continue test- ing with <u>next</u> test step. </div> <div style="text-align: center;"> no ↓ </div> </div>	Operation: Lambda closed-loop control, lower limit for closed-loop control ("lean" stop). Test adapter connects term. 24 of control unit to + 2 V.
Scale: 2.5 vol. %			Malfunction: CO-level unchanged
Connection: On the test fixture			
Operation in vehicle: Let engine run (operating temperature).			



Arrow = CO connection before catalytic converter (cyl. 4, 5, 6)

- 1 = Control unit
- 2 = Lug
- 3 = Plug detent
- 4 = Fastening holes



Trouble-shooting:

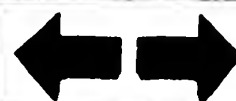
Take out and replace the control unit.

Note:

In order to preclude confusing the control units for the various systems one for the other, a mechanical encoding system has been introduced. The "lug" (pivot point for connecting and disconnecting the control unit) and the corresponding receptacle on the control unit have recesses or pins that fit one another.

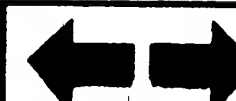
G20

Testing with universal test adapter
BMW



G21

Testing with universal test adapter
BMW



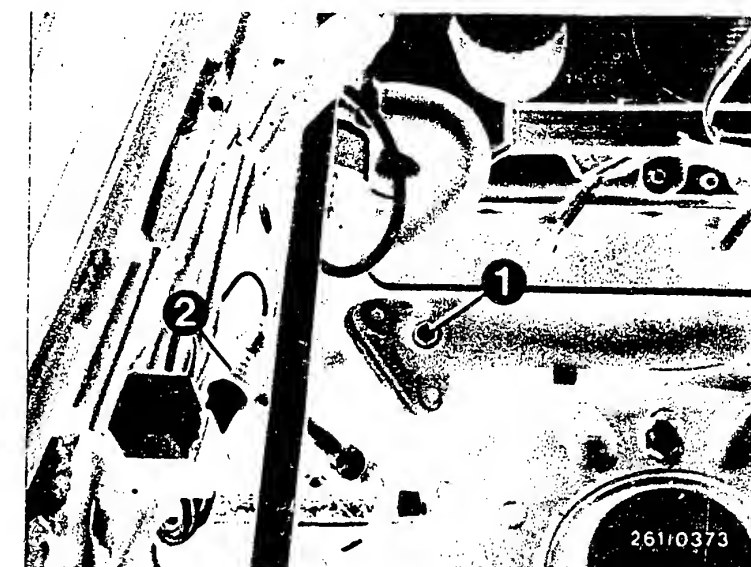
TEST STEP 45			
Operation		Reading	Testing
Program switch "V" to position:	20	1st step: Measure CO. Wait until reading stabilizes. Slight fluctuations around a finest value in the area of	Component: Lambda sensor
Program switch "Ω" to position:	24	0.2...1.2 vol. % CO are allowable.	
Measuring instrument: CO tester		2nd step: During CO measurement, pull air hose from fuel-pressure regulator and seal off. CO should then briefly rise and subsequently fall back to the previous control value.	Operation: Lambda closed-loop control, test adapter connects term. 25 of control unit with lambda sensor.
Measuring range: 2.5 vol. %			Malfunction: CO outside tolerance
Connection: To test fitting			
Operation in vehicle: Let engine run. Lambda sensor and cat. converter must be at operating temperature.			

Trouble-shooting;

1. Replace lambda sensor.

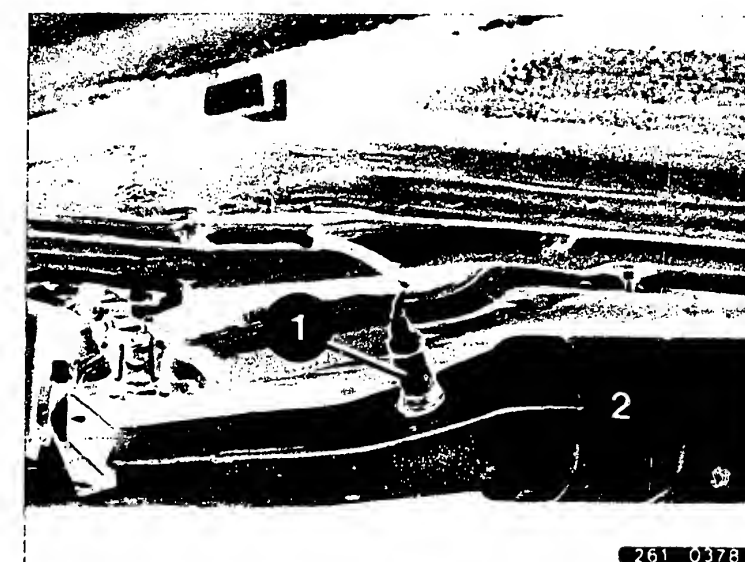
When replacing the sensor, apply special mounting paste VS 14016 Ft (5 964 080 105) to the threads. Make sure that only the thread courses are filled and that no paste gets into the slots. Clean plug-in connection of sensor lead before pulling if necessary. When plugging in, allow no dirt to get in the plug and make sure of correct engagement.

2. If 1. above unsuccessful, replace control unit.



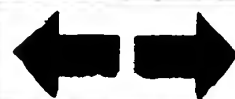
- 1 = CO connection before cat. converter (cyl. 4, 5, 6)
2 = Lambda sensor plug connection

- 1 = Lambda sensor
2 = Catalytic converter



G22

Testing with the universal test adapter
BMW



G23

Testing with the universal test adapter
BMW



Testing Lambda Closed-Loop Control without Test Adapter:

Test step 43a:

Test lambda closed-loop control upper limit. Separate plug connector from lambda sensor and connect to ground on control unit side (term. 24) (carry out briefly).

Test specification:	CO rises above 1.2 vol. %.
Malfunction:	No CO change
Trouble-shooting:	Lead to term. 24; replace control unit

Test step 44a:

Test lambda closed-loop control upper limit. After disconnecting lead to control unit (term. 4), connect to approx. + 2 V (e.g. 1.4 V single-cell battery; positive to term. 24, negative to vehicle ground.)

Test value:	CO falls below 0.2 vol. % (engine runs unevenly)
Malfunction and trouble-shooting as for test step 43a.	

Test step 45a:

Test lambda sensor in closed-loop operation. Connect plug connection from lambda sensor.

Test specification:	CO = 0.2...1.2 vol. %.
---------------------	------------------------

Pull air hose from fuel-pressure regulator and seal off.

Test specification:	CO rises briefly and is regulated at value above.
Malfunction:	No CO change.
Trouble-shooting:	Interrupt lead between lambda sensor and its plug connection; replace lambda sensor.

Testing with the universal test adapter is now completed. If the fault has not been found or if you require further information on how to remedy the fault, continue with the trouble-shooting program you have chosen.

Detailed trouble-shooting	→ C3...C4
Direct trouble-shooting	→ C5...C10.



STARTING MOTOR TURNS, ENGINE DOES NOT START OR STARTS ONLY WITH DIFFICULTY

10. Trouble-shooting program according to customer complaint

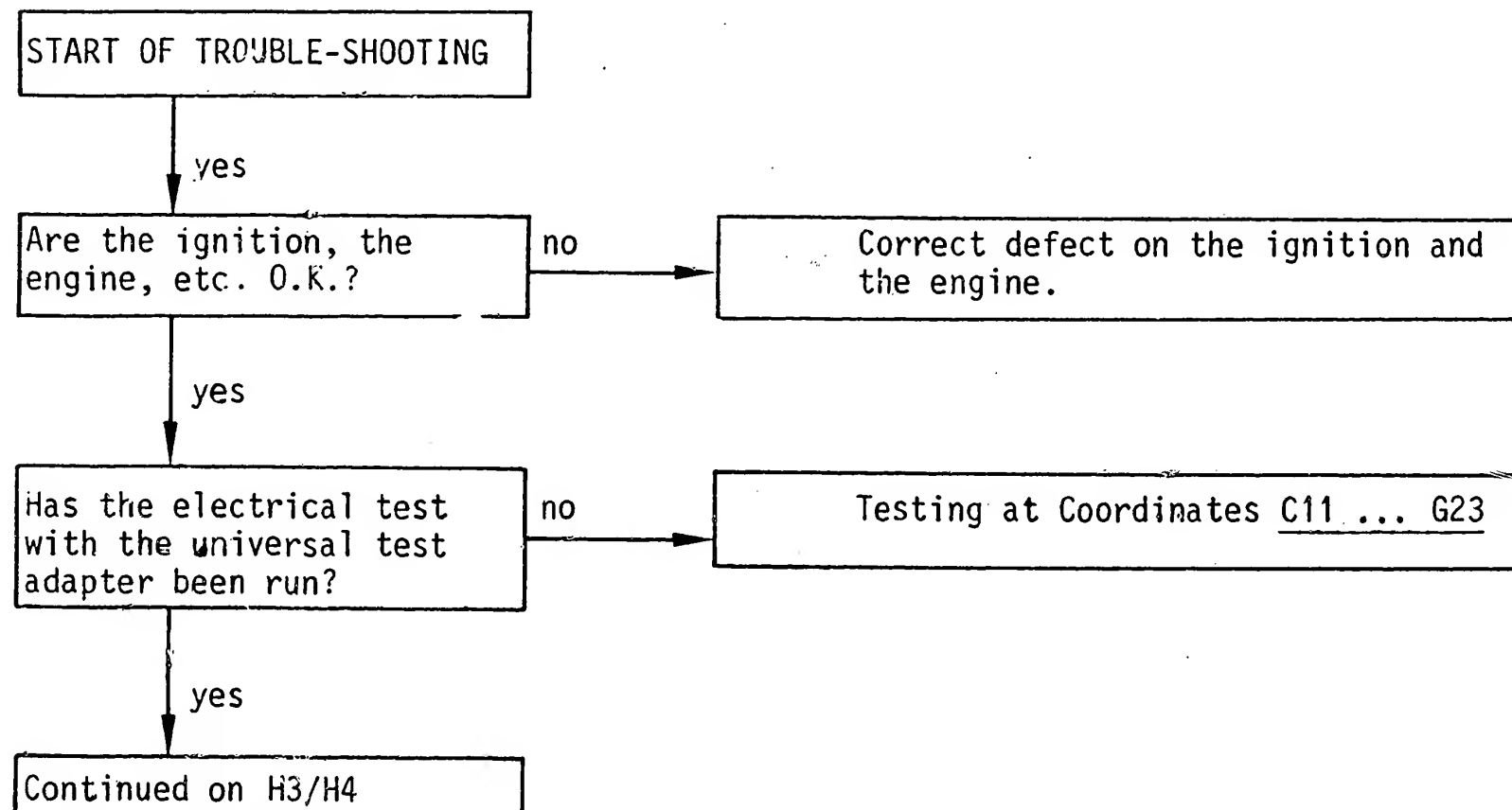
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the texts being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble shooting is continued at that point at which the shift was made previously.



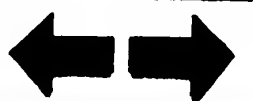
H1

Engine does not start
BMW



H2

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Check the secondary pattern for all cylinders at starting speed. Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal).
Notes:

Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder numbers! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx. 0Ω). Secondary coil resistance: 5 to $7.2k\Omega$. Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference suppression resistance in
Ignition distributor rotor: 1 $k\Omega$
Ignition distributor housings: each 1 $k\Omega$
Spark-plug connectors: each 5 $k\Omega$
Spark plugs: 5 $k\Omega$
Ignition coil: 1 $k\Omega$

yes

During the starting process, feel all solenoid-operated fuel-injection valves by hand. Is the movement of the needle perceptible in each of them?

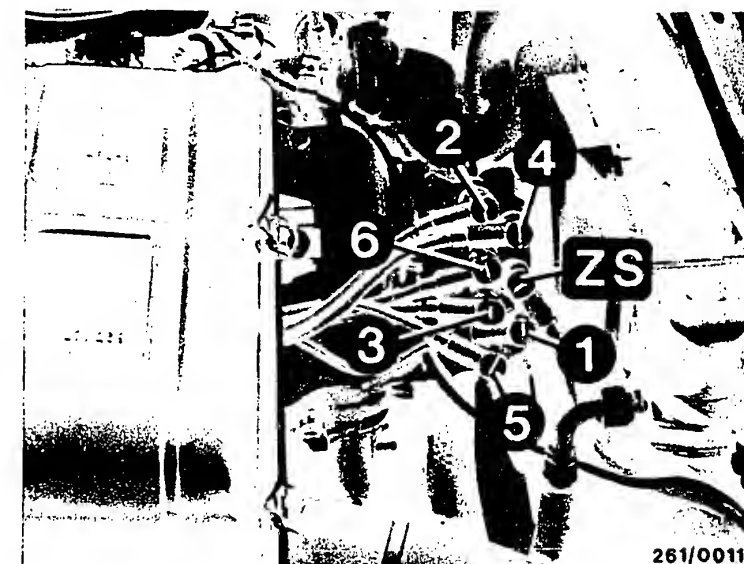
no

Check the solenoid-operated fuel-injection valve with an ohmmeter.
Test specification: 15 ... 17,5 Ω
If need be, take up and replace a defective solenoid-operated fuel-injection valve

yes

Continued on H9/H10

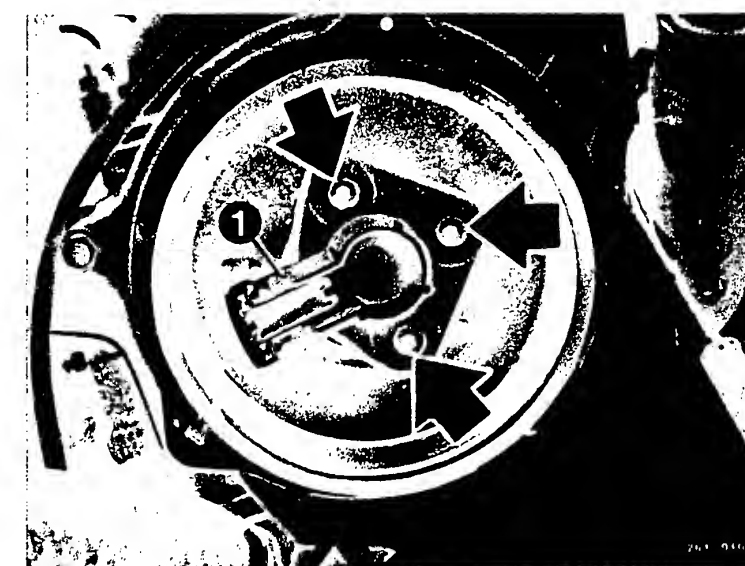
Continued on H5/H6



261/0011

High voltage distributor
1 - 6 = Cylinder numbers
ZS = High voltage lead to the ignition coil

1 = Distributor rotor
Arrow = Fastening screws



H3

Engine does not start
BMW



H4

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Taking out the solenoid-operated fuel-injection valves

Release the fastening screws on the fuel distribution pipe. Pull the fuel distribution pipe up until the solenoid-operated fuel-injection valves are out of the hole in the intake manifold. Do not damage the nozzle needle or the rubber gasket.

Check the nozzle needles and the area around them for tightness of seal and for dirt deposits.

Disconnect the electrical connection.

Carefully shove the holding bracket out of the slot and pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe connection.

Caution!

Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine. Fire hazard!

Caution!

The protection sleeve must not be pried off.

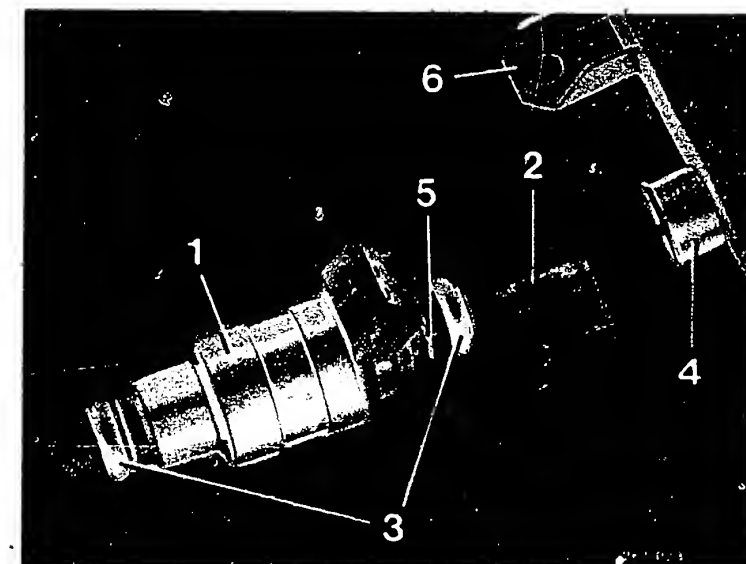
Installation of the solenoid-operated fuel-injection valves.

Take out and replace damaged or swollen O-rings. Use set of parts 1 287 010 704.

Cut the lower O-ring (intake tube) into pieces.

Caution! Do not damage the protection sleeve.

Pull a new O-ring over the protection sleeve and the shoulder on it. Do not damage any parts in so doing.



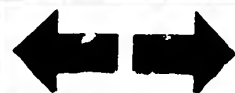
- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on H9/H10

Continued on H7/H8

H5

Engine does not start
BMW



H6

Engine does not start
BMW

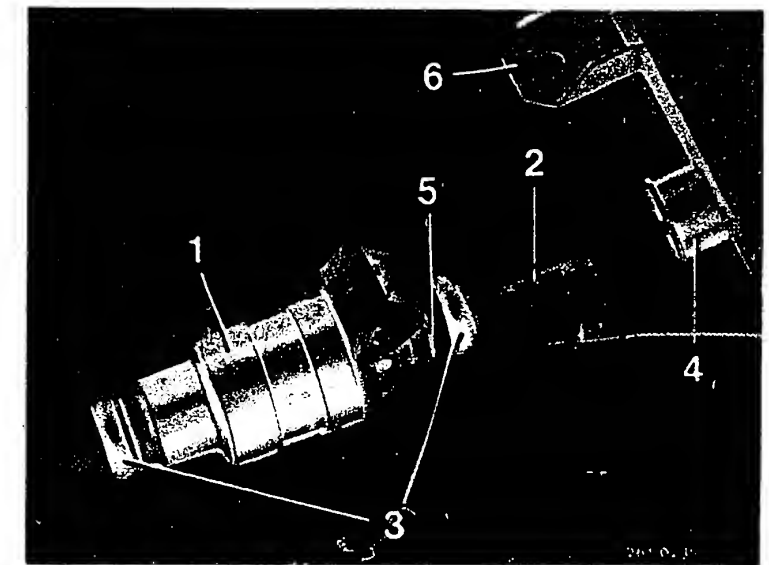


Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Before installation, check both rubber gaskets for proper seating. Fasten the solenoid-operated fuel-injection valves to the fuel distribution pipe. All solenoid-operated fuel-injection valves are to be pressed into the seats at the same time using the fuel distribution pipe. Screw the fuel distribution pipe tight. Check all air and fuel hoses for proper seating. Make electrical connections.

Start the engine and check that no unmetered air is being drawn in.



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on H9/H10

H7

Engine does not start
BMW



H8

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Idle-mixture control OK?

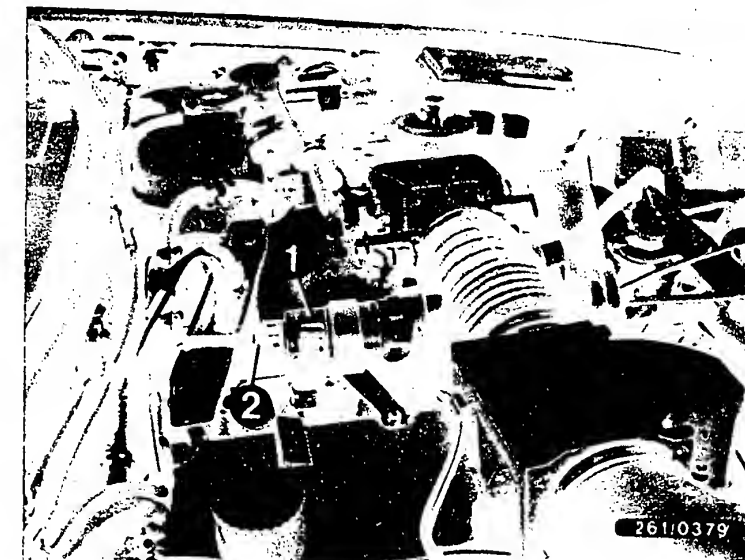
no

Measure the coil resistance of the idle actuator (figure at the center - Item 1): if there is a break or if the reading is 0Ω , the actuator is defective.

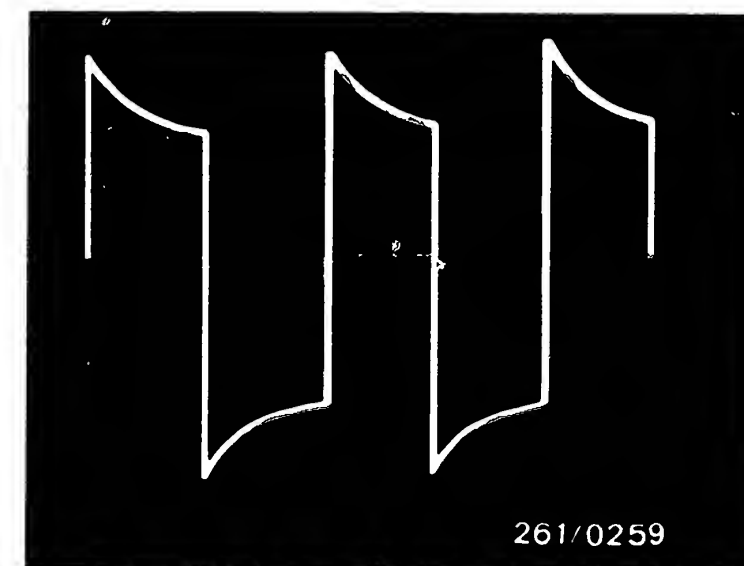
Measure the pulses on the actuator plug.
Pulses must be visible on the oscilloscope at idle speed (Figure at the bottom). If there are no pulses: check idle actuator voltage supply (+), then check leads to Motronic control unit, and if necessary replace control unit.
Further causes of trouble:
actuator mechanically defective, e.g. rotary spool not freely moveable.

yes

Continued on H11/H12



1 = Idle actuator
2 = Actuator plug



H9

Engine does not start
BMW



H10

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Is the start valve O.K.?

no

Functional test: Check the voltage supply for the start valve at start. To do so, disconnect the plug of the start valve and connect a voltmeter to Term. 73 and Term. 75/Term. 76 of the start valve plug: Reading for voltage min. 6 V, if the coolant temperature is less than $+30^{\circ}\text{C}$ (with thermotime switch $35^{\circ} / 8\text{ s}$).

Coolant with engine at normal operating temperature (approx. $+80^{\circ}\text{C}$):
Reading for voltage approx. 0 V.

Check the following leads with an ohmmeter for continuity (specified value approx. $0\ \Omega$):

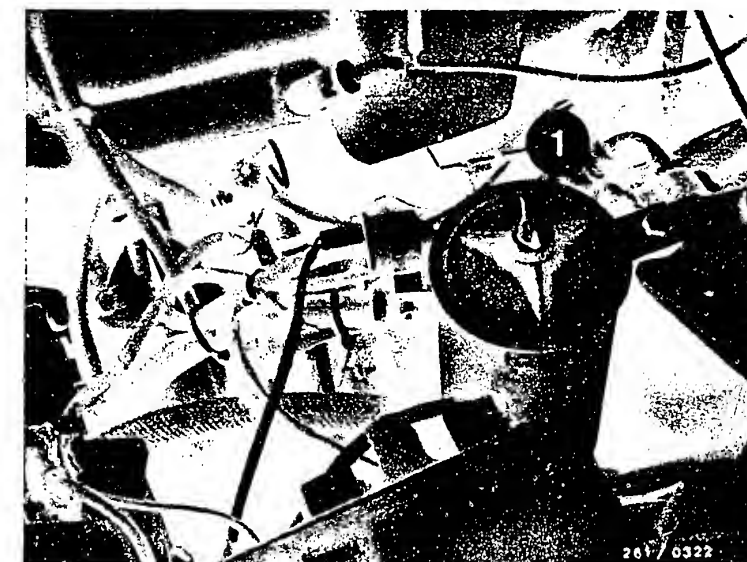
- Lead from start valve Term. 73 to the thermotime switch Term. W
- Lead from the start valve Term. 75/76 to the thermotime switch Term. G
- Lead from the start valve Term. 75/76 to the starting motor Term. 50

Check the ground connections for the thermotime switch

yes

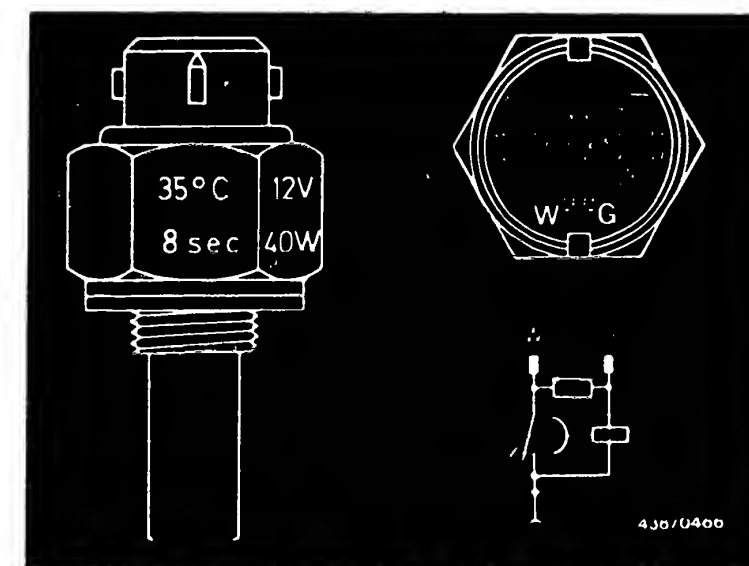
Continued on H13/H14

Continued on H13/H14



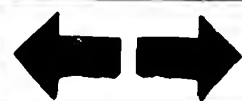
1 = Start valve (below on intake manifold)

Thermo-time switch



H11

Engine does not start
BMW



H12

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

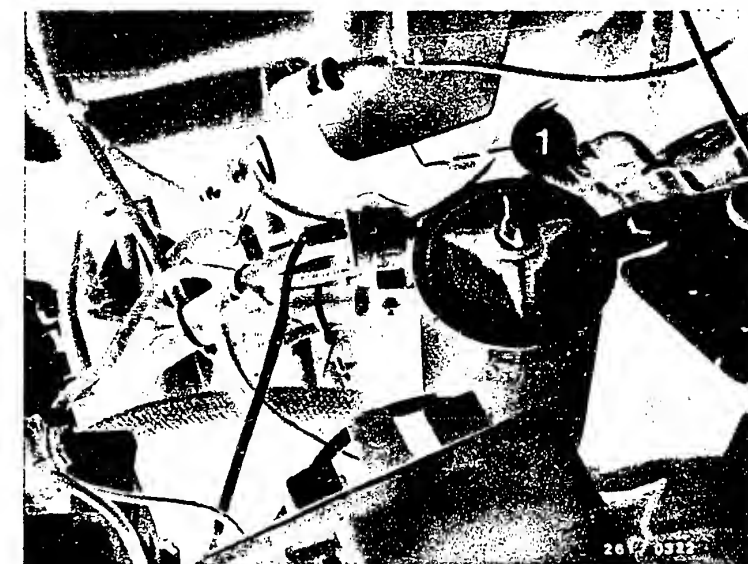
Check the start valve electrically:
Connect an ohmmeter to the start valve.
(Disconnect the connecting plug.)
Specified value approx. 4Ω

Check the start valve mechanically:
Remove the start valve from the intake pipe and hold it into a container. (Caution: fire hazard!)
During start, and at temperatures less than $+30^{\circ}\text{C}$, the start valve must spray fuel (max. 8 s).
With the engine at normal operating temperature (approx. $+80^{\circ}\text{C}$), the start valve must not spray fuel. With the ignition switched on, and the pressure built up, it is likewise not permissible for the start valve to spray fuel.

yes

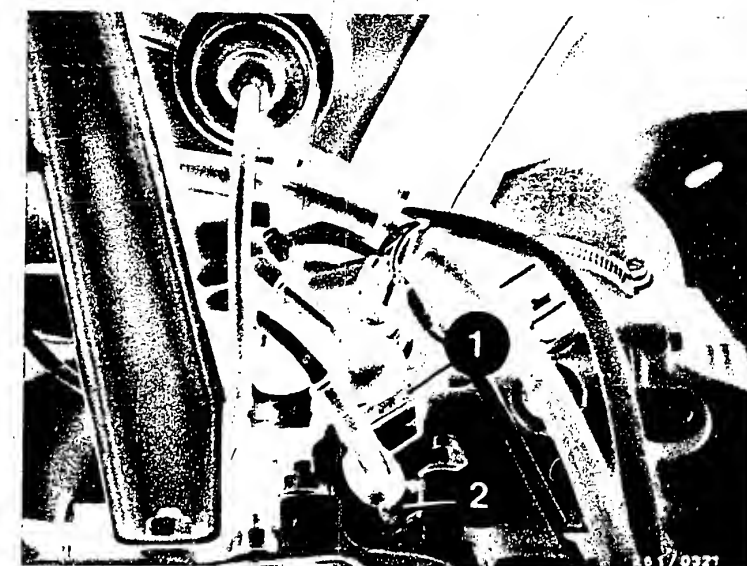
Continued on H15/H16

Continued on H15/H16



1 = Start valve (below on intake manifold)

- 1 = Thermo-time switch (brown plug)
2 = Engine temperature sensor (white plug)



H13

Engine does not start
BMW



H14

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

Run the fuel spray test with the engine at normal operating temperature (approx. +80° C) as follows: disconnect the plug from the thermotime switch and ground Term. W.

Check the start valve for leaks:

1. In the engine

Clamp off the fuel delivery line at the start valve. If the engine then runs, take out and replace the start valve.

2. Taken out of the engine

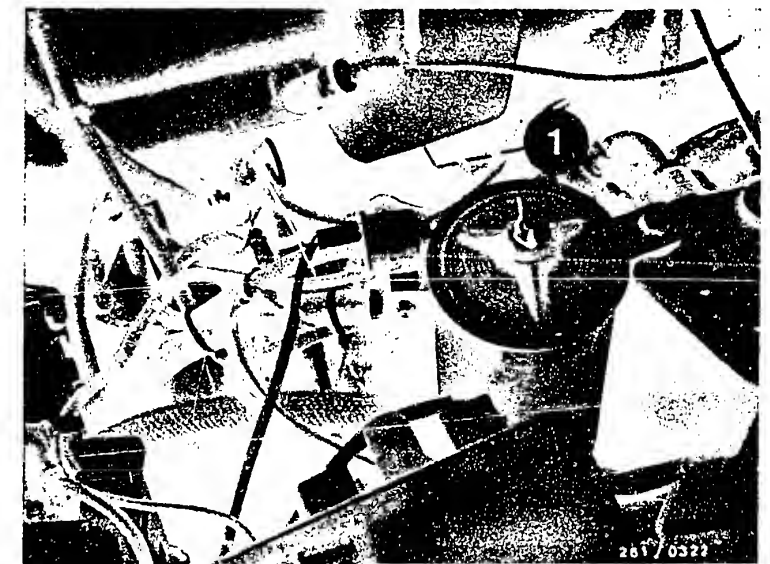
Take out the start valve.

(Caution: fire hazard!) The fuel and the electrical lines remain connected. (Place a catch basin under the start valve.) Build up the fuel pressure: on the universal test adaptor, set the program switch "V" at setting 17. Switch ignition on, and press button T3.

Test specification: the formation of max. 1 drop is permissible at the opening of the valve within one minute.

yes

Continued on H17/H18



1 = Start valve (below on intake manifold)

H 15

Engine does not start
BMW



H 16

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

Is the thermotime switch O.K.?

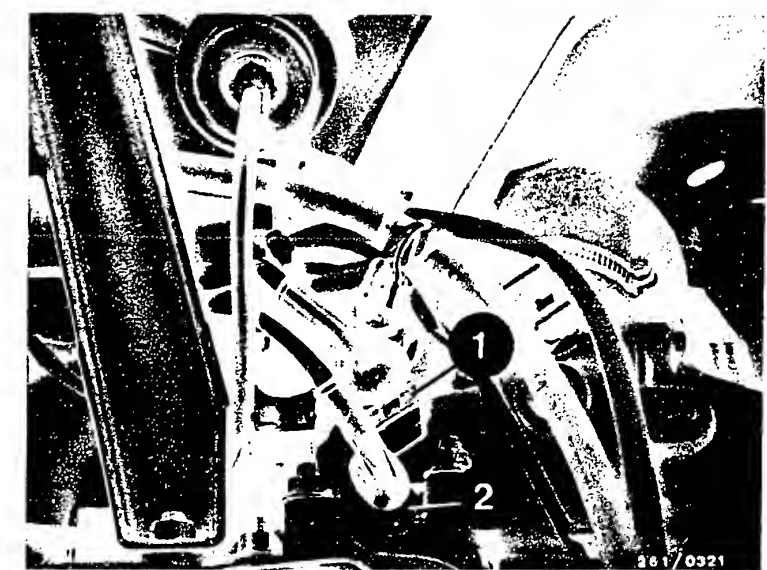
no

Electrical test
Check the thermotime switch 35°/8 s as follows: disconnect the plug and measure directly on the thermotime switch using an ohmmeter.

	Between Term. "G" and ground	Between Term. "W" and ground	Between Term. "G" and "W"
Ambient temperature (below +30° C)	25...40 Ω	0Ω	25...40 Ω
Engine at approximately normal operating temperature (above +40° C)	50...80 Ω	100...160Ω	50...80Ω

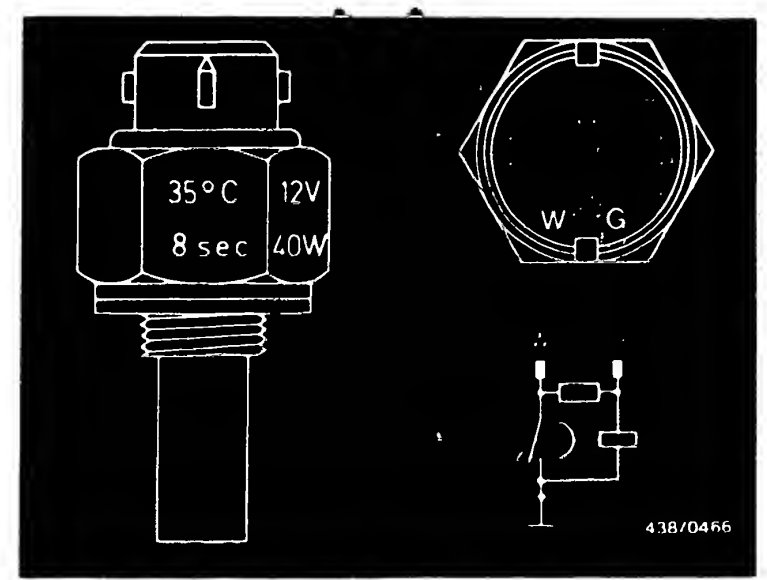
yes

Continued on H19/H20



1 = Thermo-time switch (brown plug)
2 = Engine temperature sensor (white plug)

Thermotime switch



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Is the air-flow sensor
O.K. mechanically?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and the flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for friction markings. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are friction markings present, the air-flow sensor must be taken out and replaced.

yes

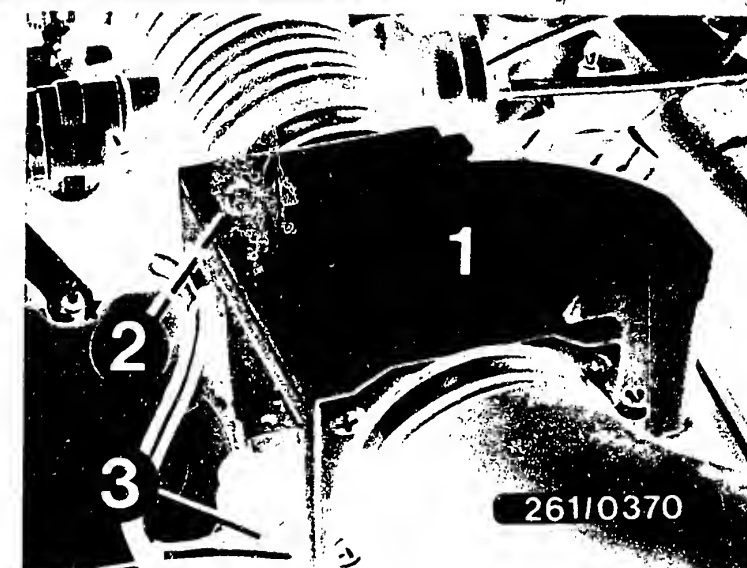
Are all the hose lines
and electrical lead
connections put on
correctly? Visual
inspection. Has the
intake system been
checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws.
Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

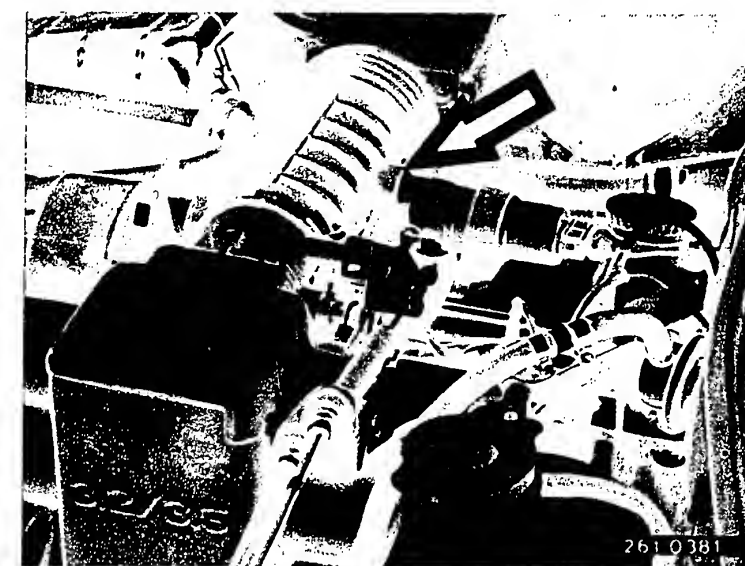
yes

Continued on H21/H22



- 1 = Air-flow sensor with NTC I
- 2 = Idle-mixture-adjusting screw
- 3 = Air-flow sensor plug

Arrow = Disconnect hose here for
leak test.



H19

Engine does not start
BMW



H20

Engine does not start
BMW



Starting motor turns, engine does not start or starts only with difficulty (continued)

yes

Checking the customer complaint
"Starting motor turns, engine does not or starts only with difficulty,"

has been completed.
Has the customer complaint been corrected?

no

Additional possible defects

- The customer complaint has been incorrectly identified. (See Coordinates C3 ... C10). If the defect has not been identified using the "Targeted Trouble-Shooting", see "Detailed Trouble-Shooting" (Coordinates C3/C4).
- Engine is not O.K. mechanically. (Compression, valve setting, valve timing, wear on camshaft).

H21

Engine does not start
BMW



H22

Engine does not start
BMW



ENGINE STARTS AND THEN DIES

Trouble-shooting program according to customer complaint

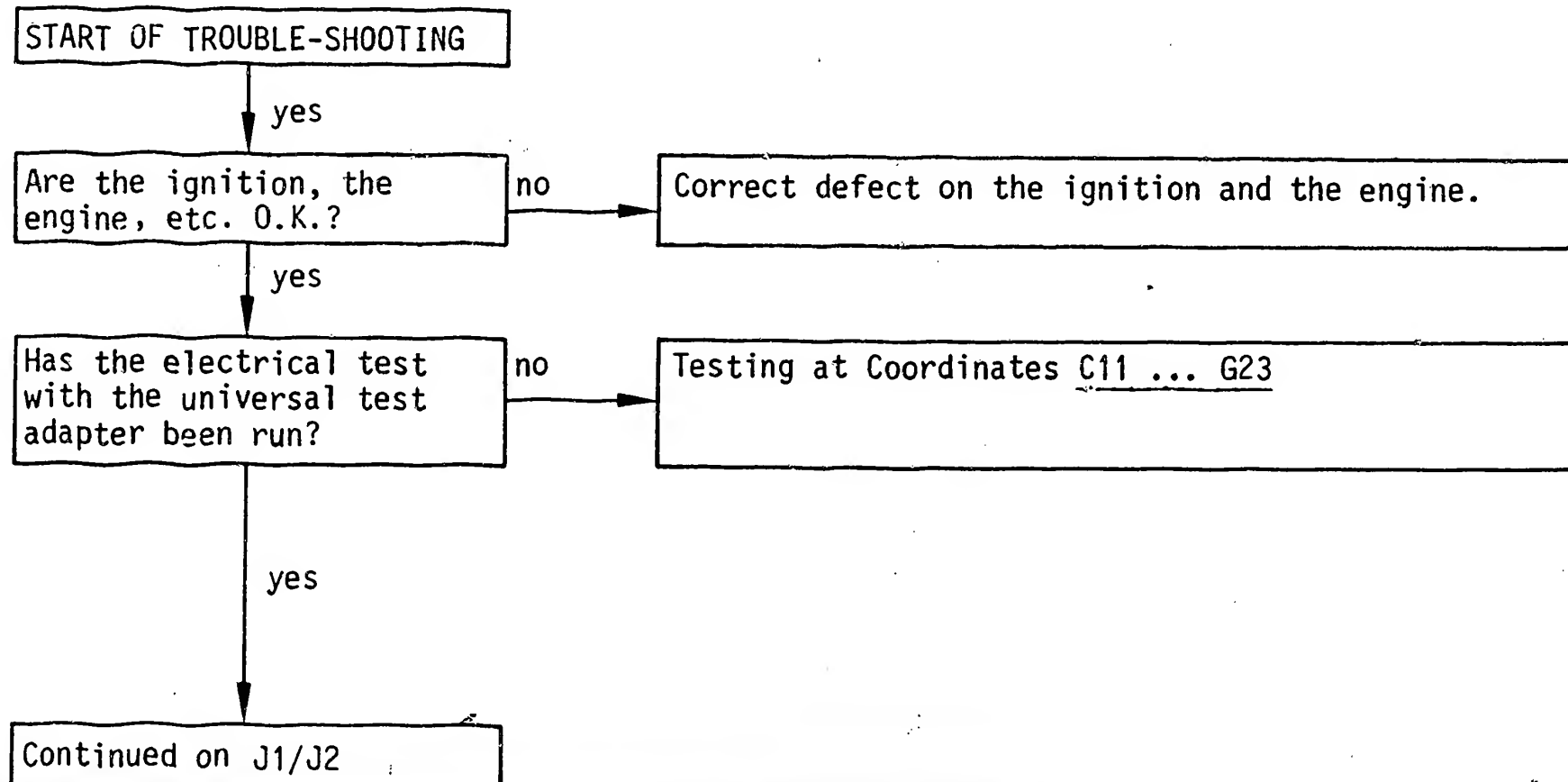
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



H23

Engine starts and then dies.

BMW

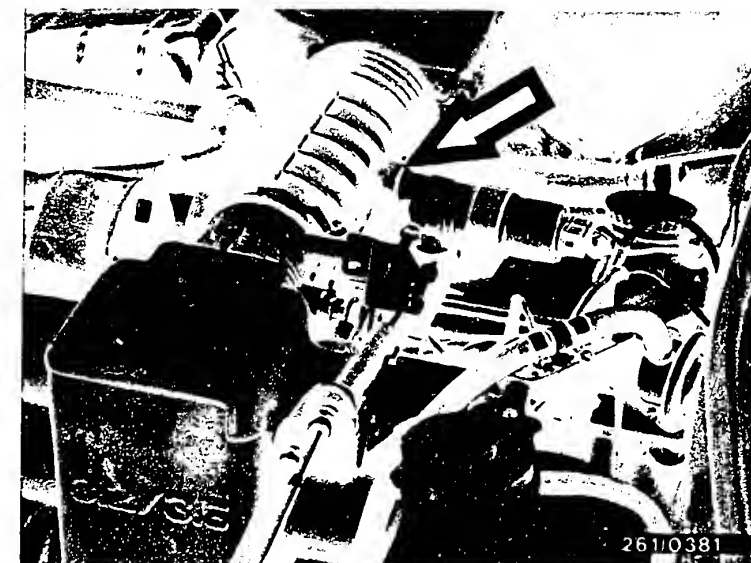


H24

Engine starts and then dies

BMW





Arrow = Disconnect hose here for leak test.

Engine starts and then dies (continued)

yes

Are all the hose lines and electrical lead connections put on correctly? Visual inspection. Has the intake system been checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws. Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

yes

Continued on J3/J4

J1

Engine starts then dies
BMW



J2

Engine starts then dies
BMW



Engine starts and then dies (continued)

yes

Idle-mixture control OK?

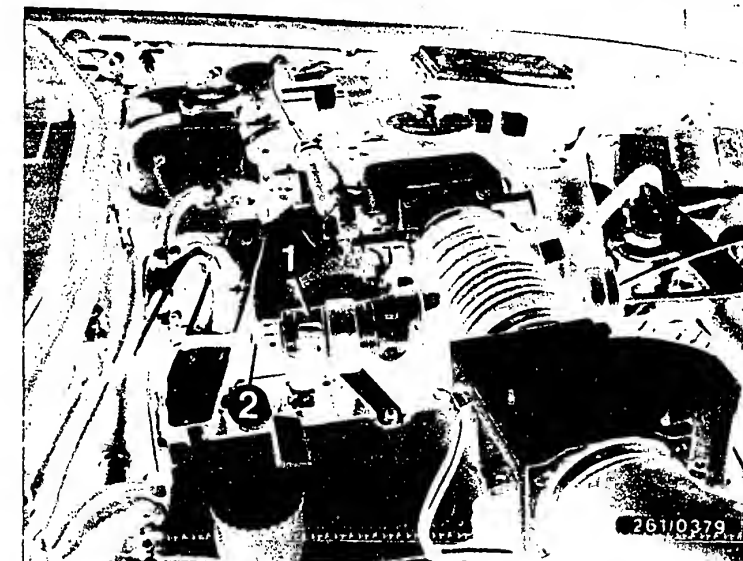
no

Measure the coil resistance of the idle actuator (figure at the center - Item 1): if there is a break or if the reading is 0Ω , the actuator is defective.

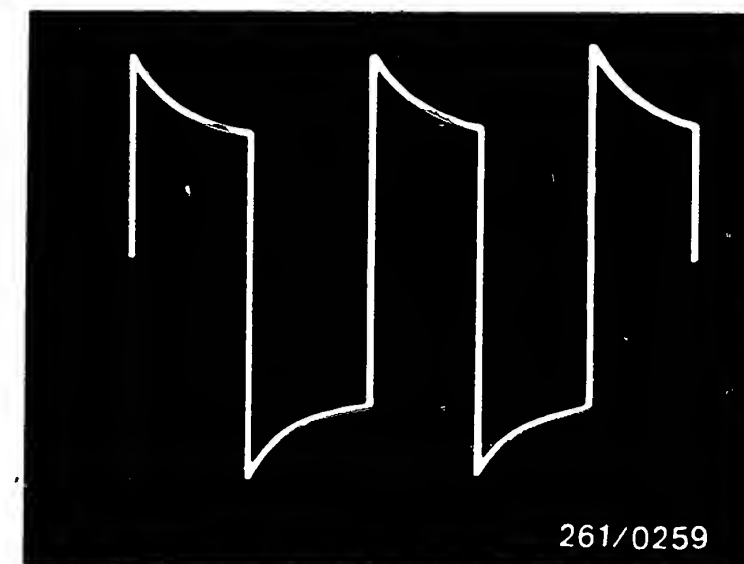
Measure the pulses on the actuator plug.
Pulses must be visible on the oscilloscope at idle speed (Figure at the bottom). If there are no pulses: check idle actuator voltage supply (+), then check leads to Motronic control unit, and if necessary replace control unit.
Further causes of trouble:
actuator mechanically defective, e.g. rotary spool not freely moveable.

yes

Continued on J5/J6



1 = Idle actuator
2 = Actuator plug



J3

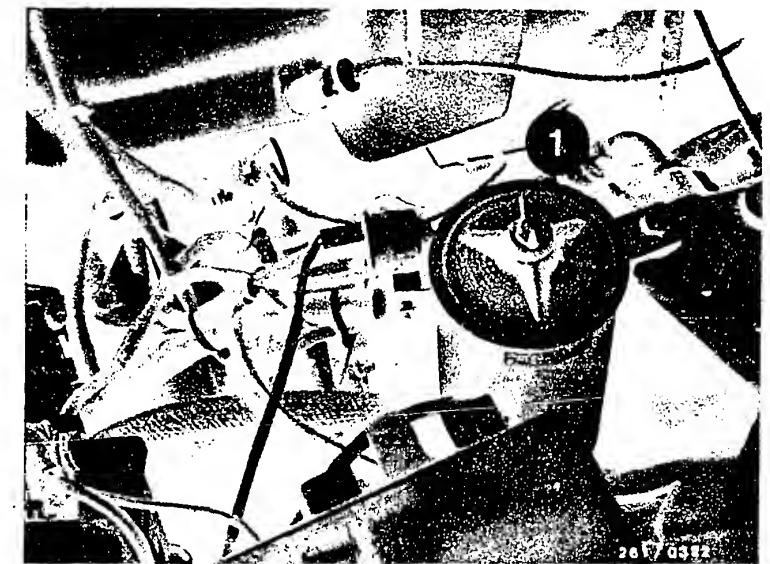
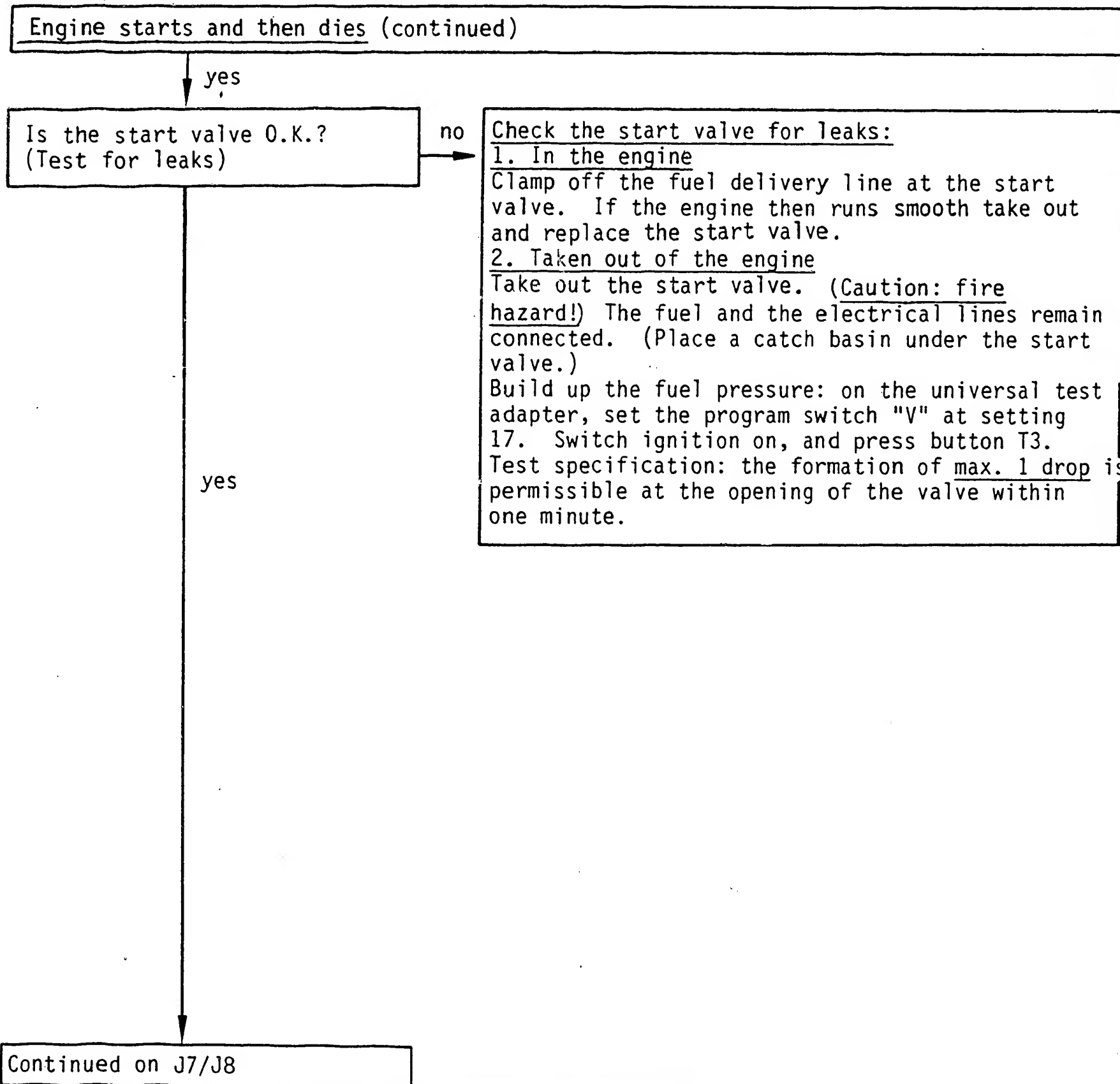
Engine starts and then dies
BMW



J4

Engine starts and then dies
BMW





1 = Start valve (below on intake manifold)

J5

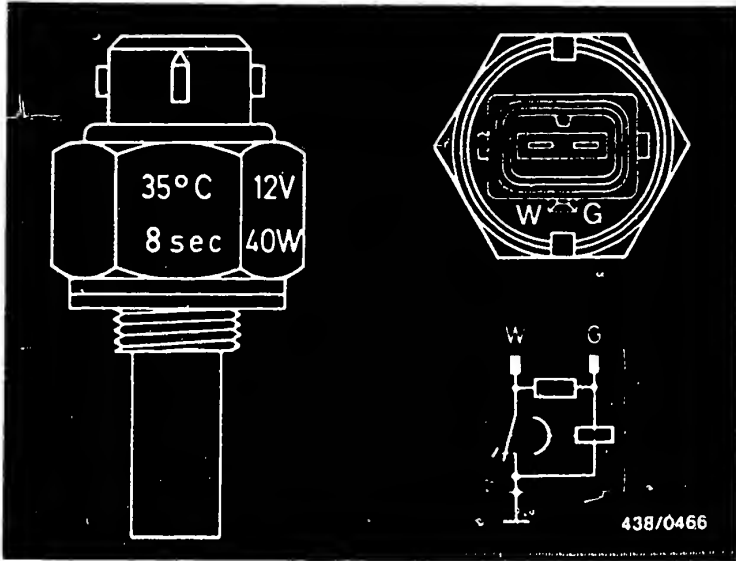
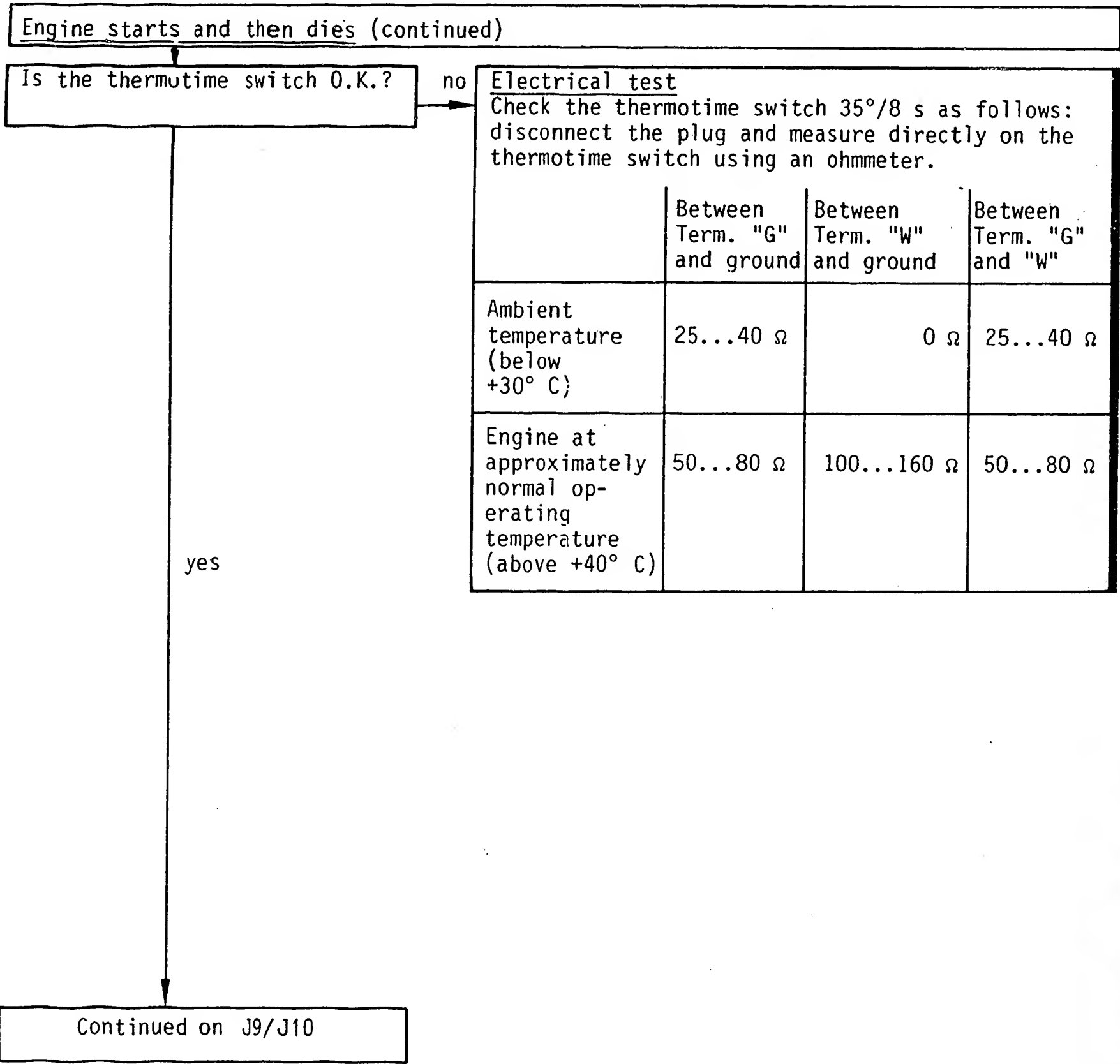
Engine starts and then dies
BMW



J6

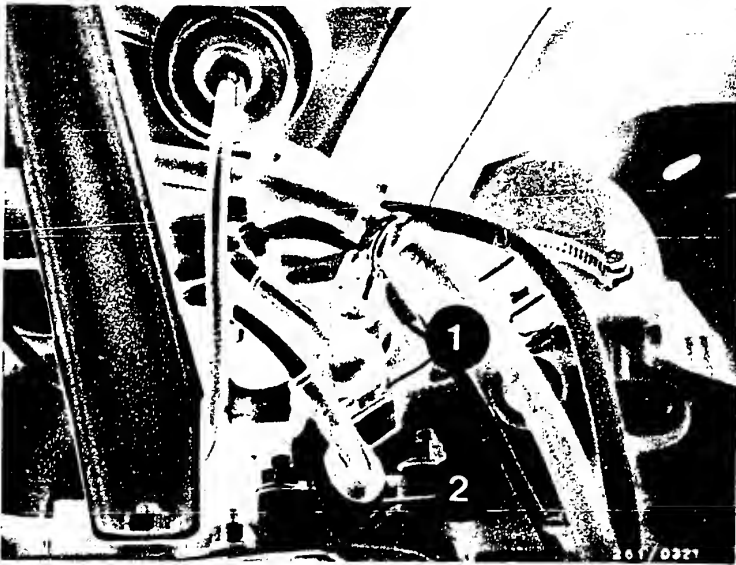
Engine starts and then dies
BMW





Thermotime switch
35° C / 8 s.

- 1 = Thermo-time switch (brown plug)
- 2 = Engine temperature sensor (white plug)



Engine starts and then dies (continued)

yes

Is the air-flow sensor O.K.?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for friction markings. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are friction markings present, the air-flow sensor must be taken out and replaced.

yes

Checking the customer complaint

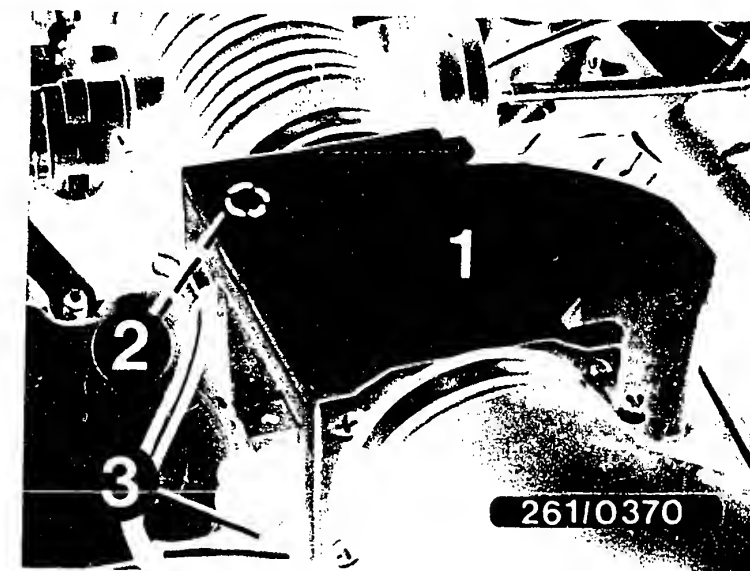
"Engine starts and then dies"

no

has been completed.
Has the customer complaint been corrected?

Additional possible defects

- The customer complaint has been incorrectly identified. (See Coordinates C3 ... C10.) If the defect has not been identified using the "Targeted Trouble-Shooting", see "Detailed Trouble-Shooting" (Coordinates C3/C4).
- Engine is not O.K. mechanically. (Compression, valve setting, valve timing, wear on camshaft).



- 1 = Air-flow sensor with NTC I
2 = Idle-mixture-adjusting screw
3 = Air-flow sensor plug

J9

Engine starts and then dies
BMW



J10

Engine starts and then dies
BMW



ROUGH IDLE, AND/OR INCORRECT IDLE SPEED

Trouble-shooting program according to customer complaint

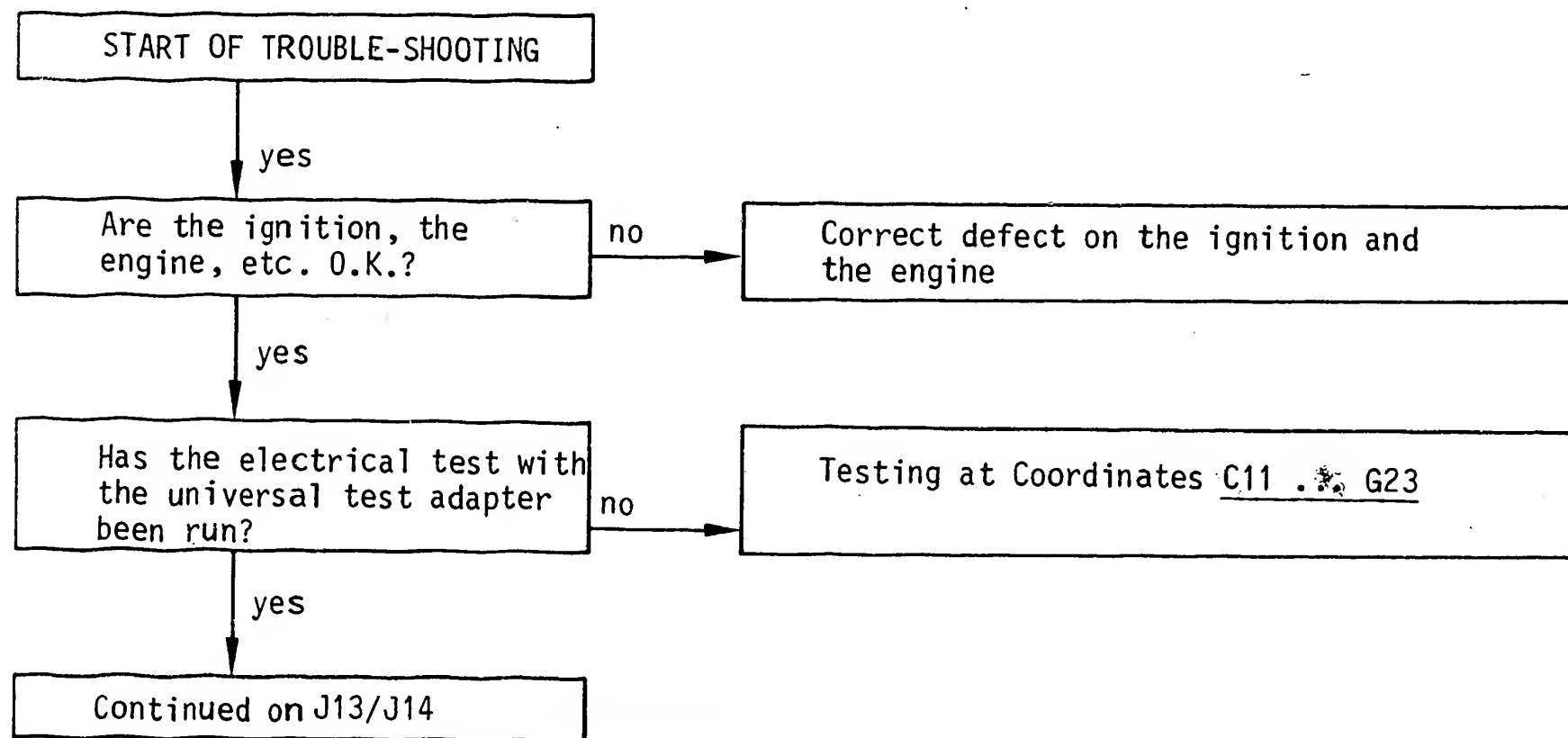
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



J11

Rough idle
BMW



J12

Rough idle
BMW



Rough idle and/or incorrect idle speed (continued)

yes

Check the secondary pattern for all cylinders.

Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal.)

Notes:

Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder number! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx. 0Ω).

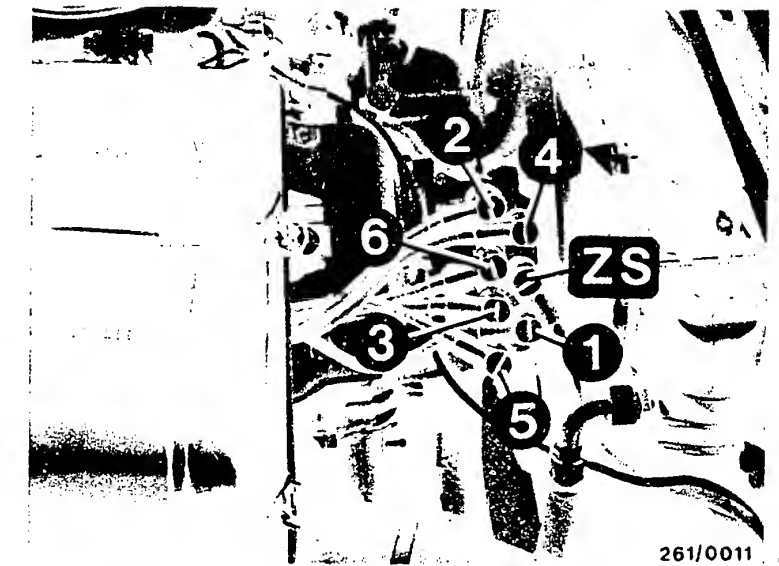
Secondary coil resistance: 5 to 7.2 k Ω . Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference-suppression resistance in

Ignition distributor rotor:	1 k Ω
Ignition distributor housings: each	1 k Ω
Spark-plug connectors: each	5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

yes

Continued on J15/J16



261/0011

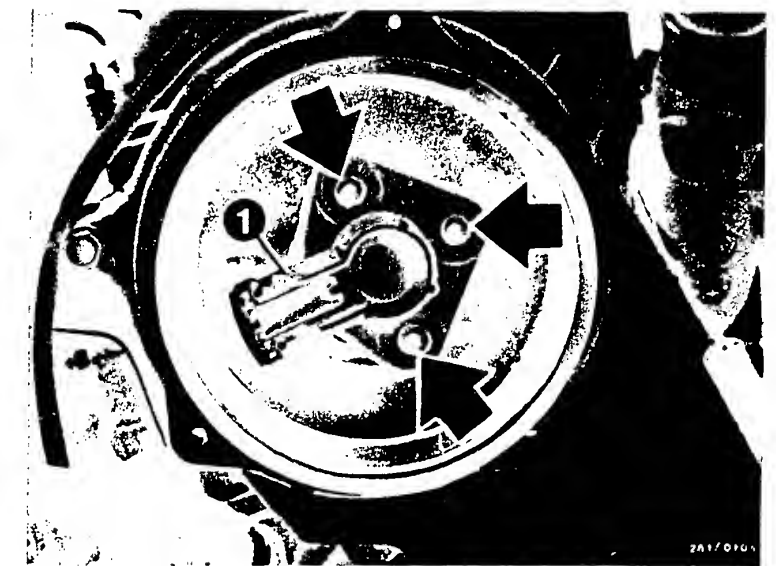
High voltage distributor

1 - 6 = Cylinder numbers

ZS = High voltage lead to the ignition coil

1 = Distributor rotor

Arrow = Fastening screws



J 13

Rough idle

BMW



J 14

Rough idle

BMW



Rough idle and/or incorrect idle speed (continued)

yes

Are all the hose lines and electrical lead connections put on correctly? Visual inspection. Has the intake system been checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws. Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

yes

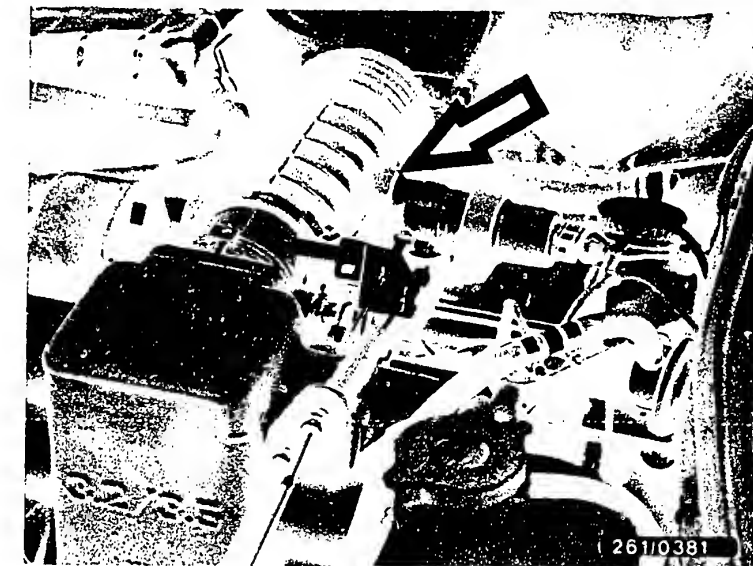
Is the air-flow sensor O.K.?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and the flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for friction markings. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are friction markings present, the air-flow sensor must be taken out and replaced.

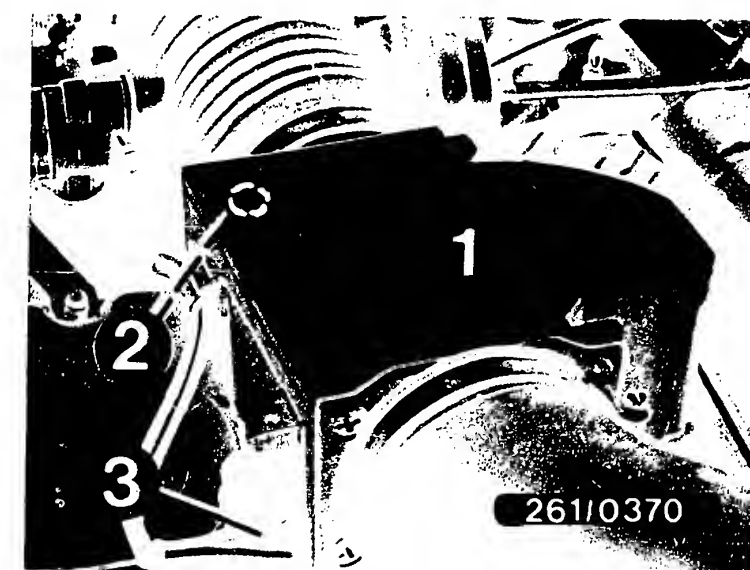
yes

Continued on J17/J18



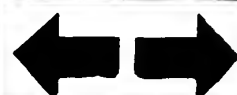
Arrow = Disconnect hose here for leak test.

1 = Air-flow sensor with NTC I
2 = Idle-mixture-adjusting screw
3 = Air-flow sensor plug



J15

Rough idle
BMW



J16

Rough idle
BMW



Rough idle and/or incorrect idle speed (continued)

yes

Idle-mixture control OK?

no

Measure winding resistance of idle actuator. Actuator is defective if there is interruption or 0 Ω .

Measure pulses at actuator plug. At idle speed pulses must be visible on oscilloscope (lower figure). If there are no pulses: check idle actuator voltage supply (+), then check leads to Motronic control unit (term. 33, 34). If necessary, replace control unit. Further cause of trouble: Actuator mechanically defective, e.g. rotary spool not freely moveable.

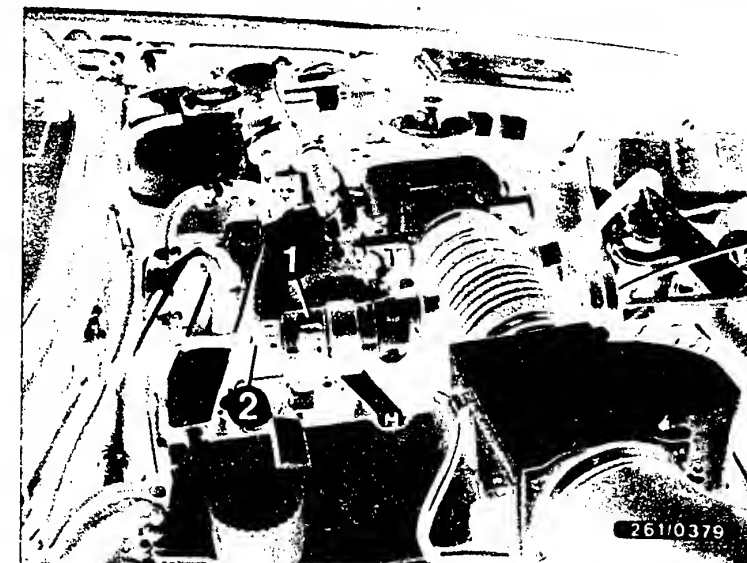
Idle-speed basic setting is done with closed idle and full-load contact. Press buttons T5 and T6 of universal test adapter simultaneously.

If vehicle has electronic transmission control, previously separate 13-pin plug or disconnect transmission control unit.

Nominal engine speed 750...800 min⁻¹
If necessary, correct at throttle-valve stop, and then reset throttle-valve switch.

yes

Continued on J19/J20

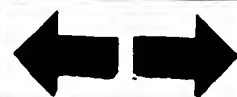


1 = Idle actuator
2 = Actuator plug



J17

Rough idle
BMW



J18

Rough idle
BMW



Rough idle and/or incorrect idle speed (continued)

Is the thermotime switch O.K.?

no

Electrical test:

Check the thermotime switch 35° C/8 s as follows: disconnect the plug and measure directly on the thermotime switch using an ohmmeter.

1. Between Term. "G" and ground at ambient temperature (less than +30° C):

25 ... 40Ω. With engine at approximately normal operating temperature (above +40° C): 50 ... 80Ω.

2. Between Term. "W" and ground at ambient temperature (less than +30° C):

0Ω. With engine at approximately normal operating temperature (above 40° C): 100 ... 160Ω

3. Between Term. "G" and "W" at ambient temperature (less than +30° C): 25 ... 40Ω.

With engine at approximately normal operating temperature (above 40° C): 50 ... 80Ω

yes

Is the start valve O.K.?

no

Check the start valve for leaks:

1. In the engine

Clamp off the fuel delivery line at the start valve. If the engine then runs smooth, take out and replace the start valve.

2. Taken out of the engine

Take out the start valve. (Caution: fire hazard!)

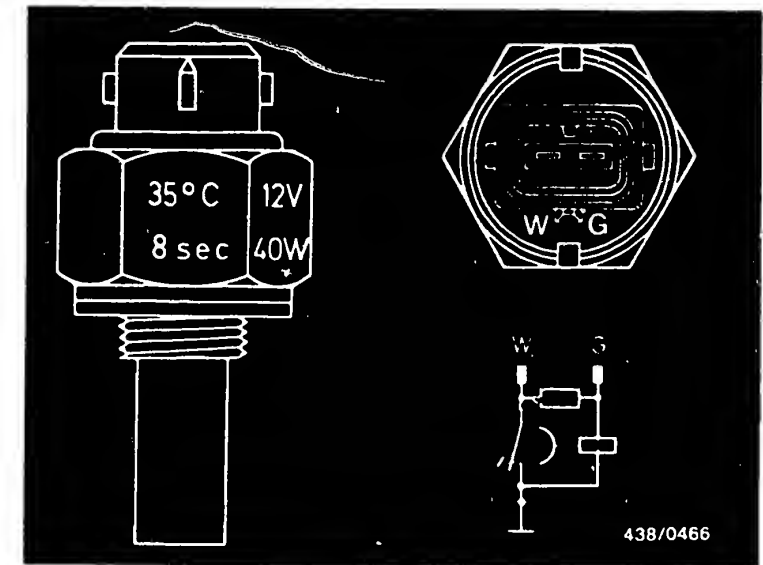
The fuel and the electrical lines remain connected. (Place a catch basin under the start valve.)

Build up the fuel pressure: on the universal test adapter, set the program switch "V" at setting 17. Switch ignition on, and press button T3.

Test specification: the formation of max. 1 drop is permissible at the opening of the valve within one minute.

yes

Continued on J21/J22



Thermotime switch
35° C / 8 s.

1 = Start valve (below on intake manifold)



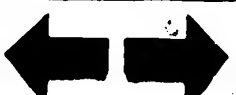
J19

Rough idle
BMW



J20

Rough idle
BMW



Rough idle and/or incorrect idle speed (continued)

yes

Solenoid-operated fuel-injection valves:

1. Mechanically O.K.?
2. O-ring O.K. (unmetered air)?

no

1. With the engine running, disconnect the solenoid-operated fuel-injection valve connectors individually, one after the other, from the injection valve, and plug them back on. If the solenoid-operated fuel-injection valve is good, the engine speed must drop off. If not, take out and replace the solenoid-operated fuel-injection valve.

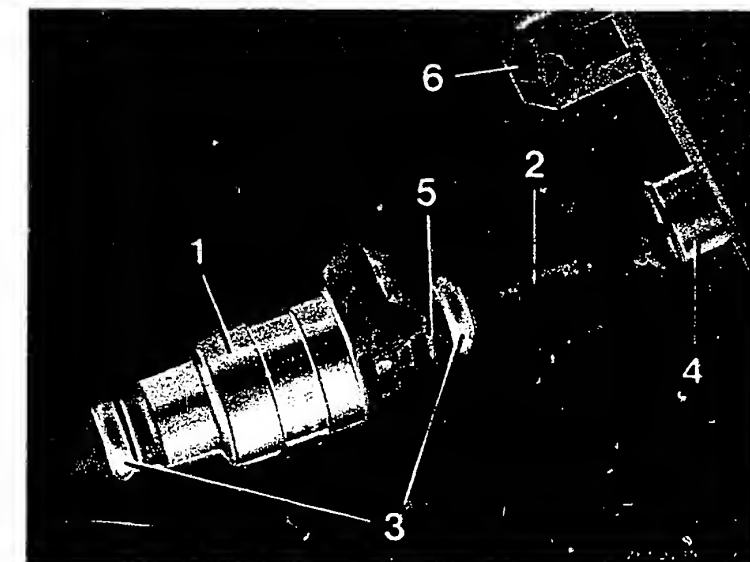
2. Defective O-rings on the protection sleeve lead to unmetered air and thus to leaning of the mixture. Defective O-rings at the fuel distributor pipe cause leaks and thereby leakage. Take out and replace defective O-rings.

3. If the solenoid-operated fuel-injection valves are clogged with dirt deposits, take out and replace the solenoid-operated fuel-injection valves.

Taking out the solenoid operated fuel-injection valves

Release the fastening screws on the fuel distribution pipe. Pull the fuel distribution pipe up until the solenoid-operated fuel-injection valves are out of the hole in the intake manifold. Do not damage the nozzle needle or the rubber gasket. Check the nozzle needles and the area around them for tightness of seal and for dirt deposits. Disconnect the electrical connection. Carefully shove the holding bracket out of the slot and pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe connection.

yes



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on K1/K2

Continued on J23/J24

J21

Rough idle
BMW



J22

Rough idle
BMW



Rough idle and/or incorrect idle speed (continued)

yes

Caution!

Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine. Fire hazard!

Caution!

The protection sleeve must not be pried off.
Installation of the solenoid-operated fuel-injection valves

Take out and replace damaged or swollen O-rings.
Use set of parts 1 287 010 704.

Cut the lower O-ring (intake tube) into pieces.

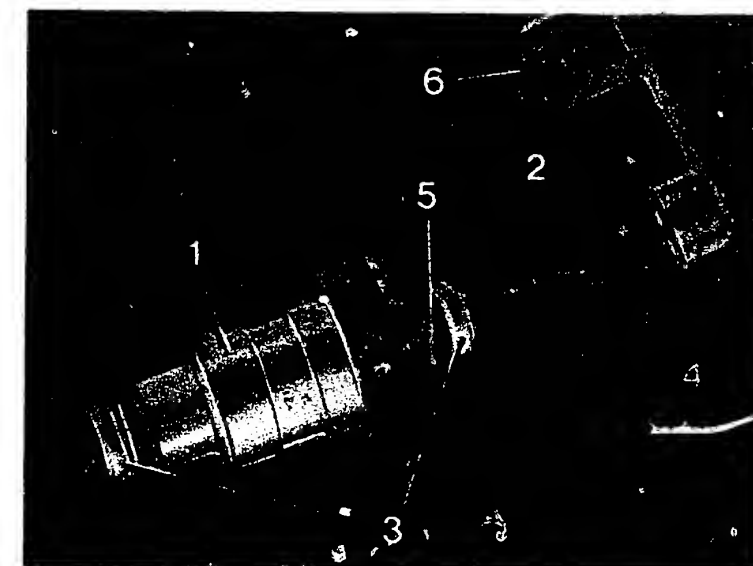
Caution! Do not damage the protection sleeve.

Pull a new O-ring over the protection sleeve and the shoulder on it. Do not damage any parts in so doing.

Before installation, check both rubber gaskets for proper seating. Fasten the solenoid-operated fuel-injection valves to the fuel distribution pipe. All solenoid-operated fuel-injection valves are to be pressed into the seats at the same time using the fuel distribution pipe. Screw the fuel distribution pipe tight. Check all air and fuel hoses for proper seating.

Make electrical connections.

Start the engine and check that no unmetered air is being drawn in.



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on K1/K2

J23

Rough idle

BMW



J24

Rough idle

BMW



Rough idle and/or incorrect idle speed (continued)

yes

CO value OK?
Test specification:
0.2...1.2 vol. % CO
Measure before cat. converter,
plug connection from lambda
sensor separated.
Engine at operating temperature
and all electric loads switched
off.
Idle speed
750...850 min⁻¹

yes

Testing completed for customer
complaint

"Uneven engine idle, speed
adjustment (idle) and exhaust-
gas adjusting"

Customer complaint remedied?

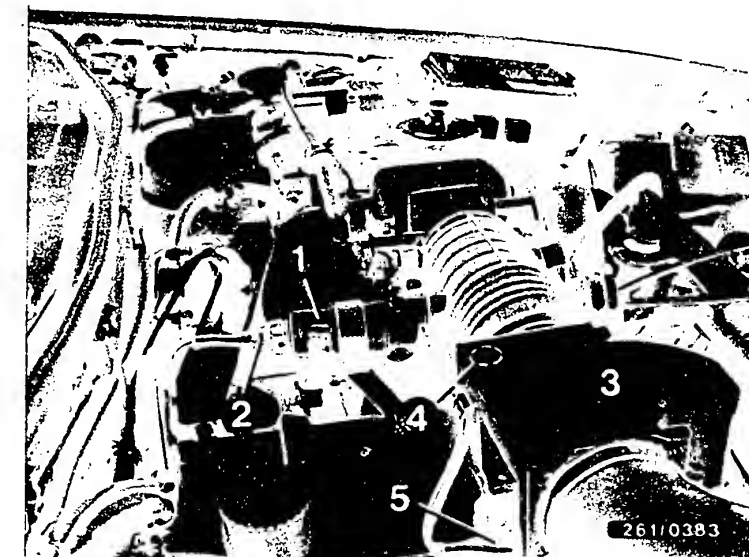
no

- For exhaust-gas adjustment remove vent
plugs in air-flow sensor with special tool
and adjust mixture-adjusting screw.
Right turn: CO value rises.
Left turn: CO value falls.
Subsequently use new vent plugs.
- If CO not adjustable and mixture too lean:
Repeat leakage test of induction system.
Mixture too rich:
Repeat measurement and adjustment with
crankshaft housing vent hose disconnected,
otherwise check air-flow sensor

no

Further possibilities

- Customer complaint incorrectly diagnosed
(see coordinates C3...C10). If the fault
was not detected by "direct trouble-
shooting", see "detailed trouble-shooting"
(Coordinates C3/C4).
- Engine not in good mechanical order
(compression, valve setting, valve timing,
worn camshaft).



- 1 = Idle actuator
- 2 = Actuator plug
- 3 = Air-flow sensor with NTC I
- 4 = Idle-mixture-adjusting screw
- 5 = Air-flow sensor plug

- 1 = CO connection before catalytic
converter (cyl. 4, 5, 6)
- 2 = Plug connection from lambda sensor



K1

Rough idle

BMW



K2

Rough idle

BMW



POOR THROTTLE TAKE-UP

Trouble-shooting program according to customer complaint

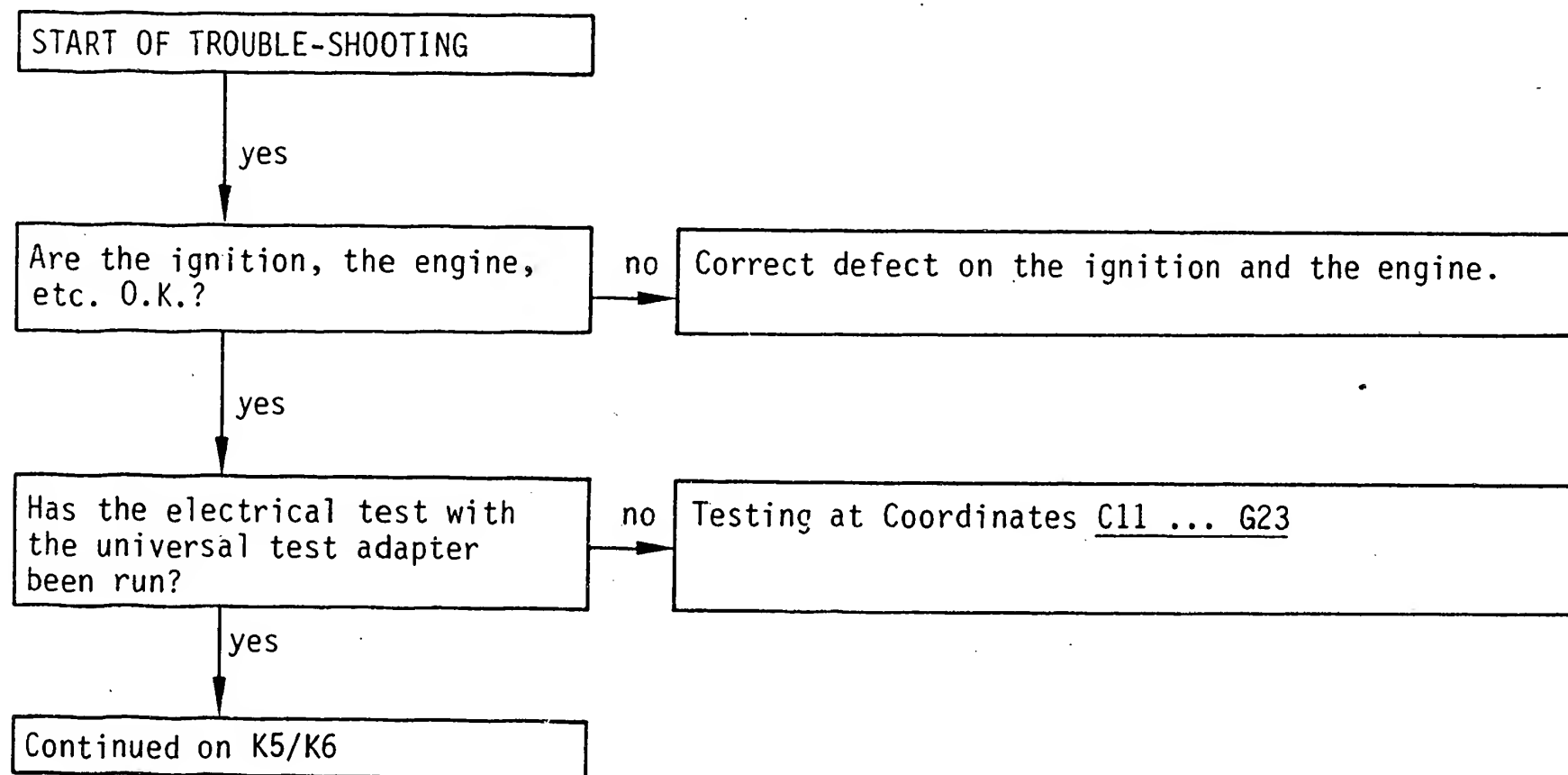
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



K3

Poor throttle take-up
BMW



K4

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Check the secondary pattern for all cylinders.
Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal).

Notes:

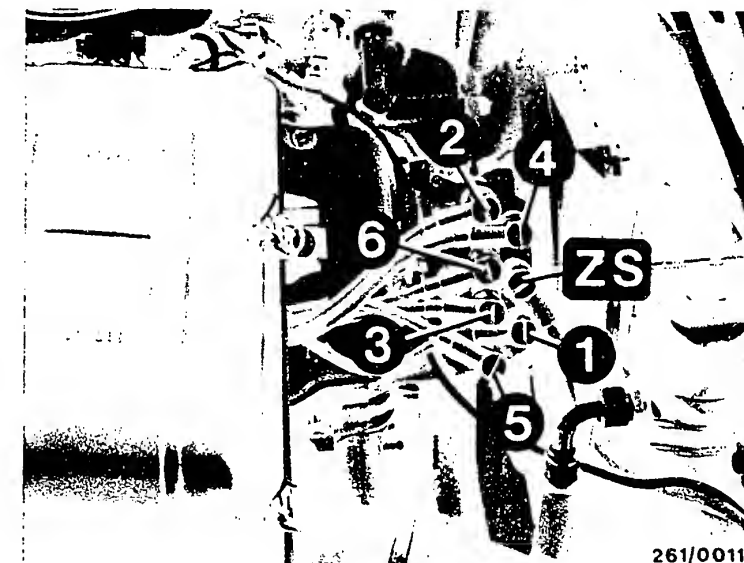
Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder numbers! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx. 0Ω). Secondary coil resistance: 5 to 7.2 k Ω . Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference-suppression resistance in

Ignition distributor rotor	1 k Ω
Ignition distributor housings:	each 1 k Ω
Spark-plug connectors:	each 5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

yes

Continued on K7/K8



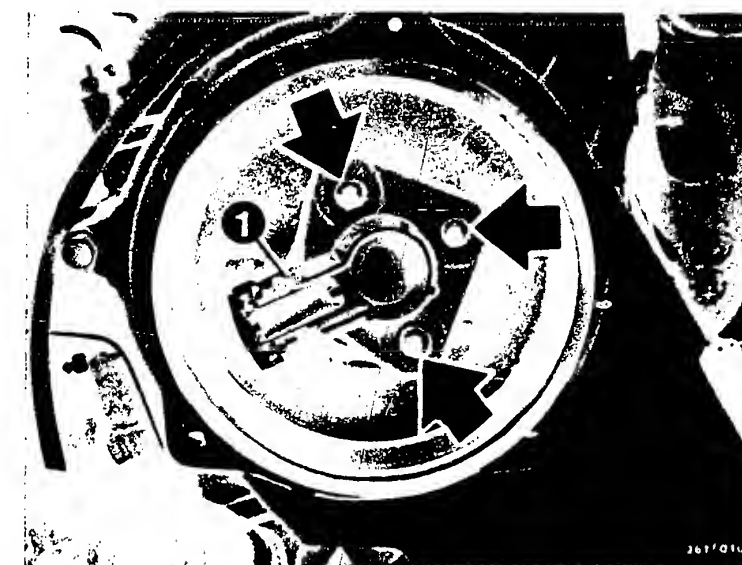
261/0011

High voltage distributor

1 - 6 = Cylinder numbers

ZS = High voltage lead to the ignition coil

1 = Distributor rotor
Arrow = Fastening screws



261/0105

K5

Poor throttle take-up
BMW



K6

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Is the throttle valve closed?

no

yes

Continued on K9/K10

Testing:

Find out whether the throttle valve can be closed even further, causing the engine speed to drop off.

Visual inspection:

Release the hose clamp and remove the hose at the throttle-valve assembly. Has the throttle valve been set for a gap? If need be, make the adjustment. After a correction, readjust the accelerator cable.

Adjusting throttle-valve switch (idle contact)

Release the fastening screws somewhat.

Connect an ohmmeter to the throttle-valve switch Term. 2 and ground. Turn the control lever to "full throttle" and slowly return it to the idle stop.

Turn the throttle-valve switch until the internal stop becomes perceptible. (Reading: 0Ω).

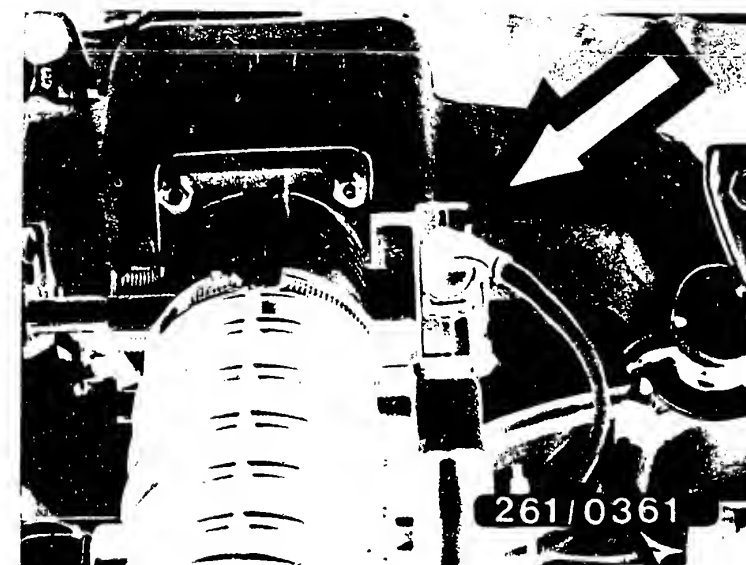
Checking the setting:

Pull on the accelerator cable somewhat. The idle contact must switch audibly. (Reading: $\infty\Omega$).

Note:

With vehicles having electronic transmission control, check also voltage at potentiometer tap (see lower picture).

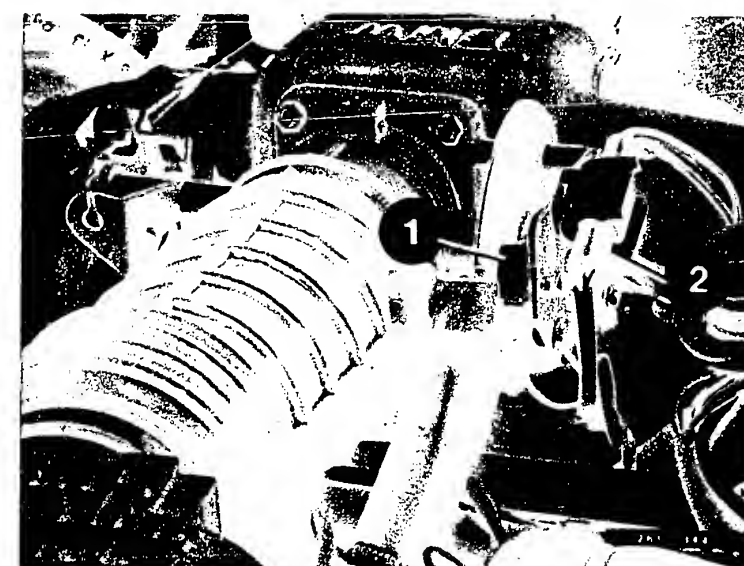
Nominal value in idle: $0.9 \pm 0.1 \text{ V}$



Arrow = Throttle-valve switch

Vehicles with electronic transmission control

- 1 = Microswitch (idle contact)
- 2 = Potentiometer (no full-load contact) (1 and 2 under rubber cap)



K7

Poor throttle take-up
BMW



K8

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Is the air-flow sensor O.K. mechanically?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and the flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for friction markings. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are friction markings present, the air-flow sensor must be taken out and replaced.

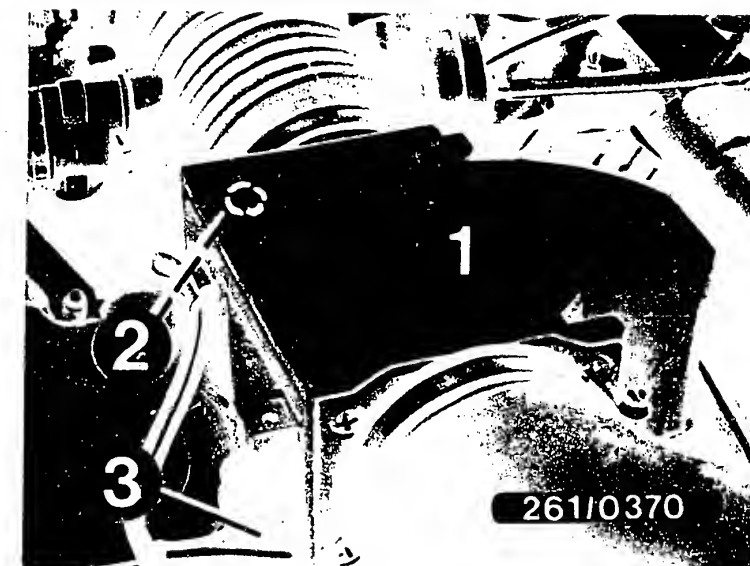
Potentiometer test (Noise test)

Take out the air-flow sensor. Leave the connecting plug plugged in. Set the motor tester at "special input" and connect the air-flow sensor Term. 7 (2)* (red clip) and Term. 6 (4)* (black clip). Set the control lever for adjustment of the picture on the motortester (calibrated setting). Switch on the ignition. Deflect the sensor flap of the air-flow sensor several times suddenly. If the air-flow sensor is good, a stroke signal without dips must appear on the oscilloscope. If the air-flow sensor is defective, a noise signal similar to the pattern shown at the right appears. Take out and replace the air-flow sensor. After testing, check the spring contacts for a tight seat.

(*) = New identification marking on the air-flow sensor.

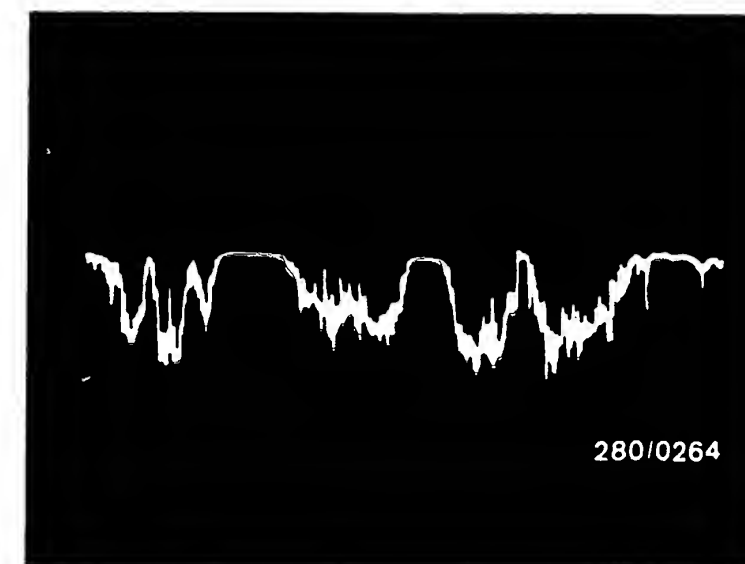
yes

Continued on K11/K12



- 1 = Air-flow sensor with NTC 1
- 2 = Idle-mixture -adjusting screw
- 3 = Air-flow sensor plug

Noise signal with defective air-flow sensor



K9

Poor throttle take-up
BMW



K10

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Are all the hose lines and electrical lead connections put on correctly? Visual inspection. Has the intake system been checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws. Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

yes

Are the solenoid-operated fuel-injection valves O.K. mechanically?

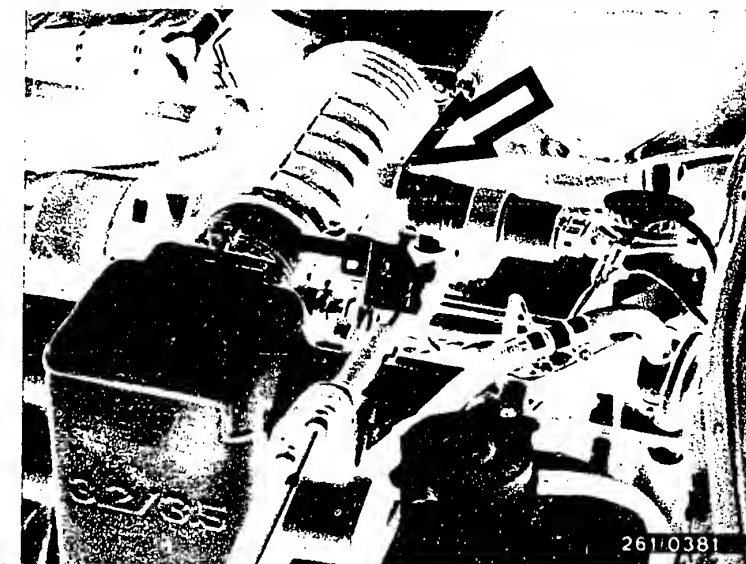
no

The solenoid-operated fuel-injection valves can be clogged by dirt deposits. Take out and replace the solenoid-operated fuel-injection valves.

yes

Continued on K17/K18

Continued on K13/K14



Arrow = Disconnect hose here for leak test.

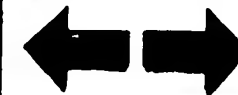
K11

Poor throttle take-up
BMW



K12

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

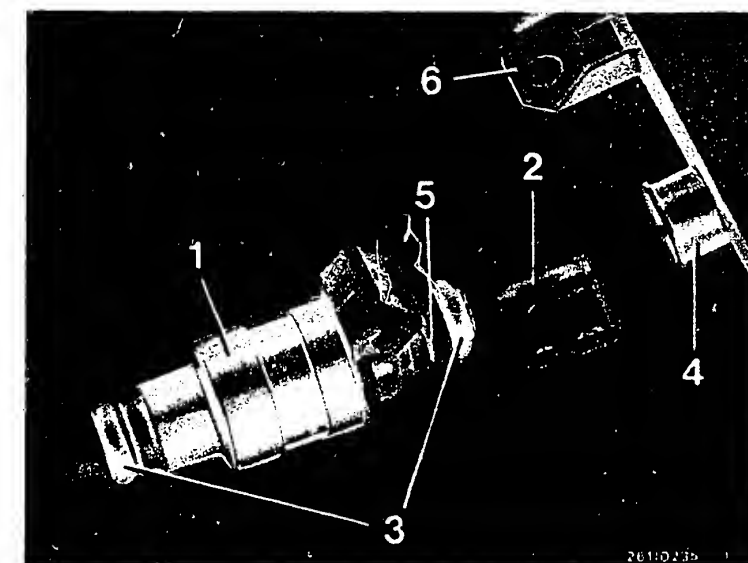
Taking out the solenoid-operated fuel-injection valves

Release the fastening screws on the fuel distribution pipe. Pull the fuel distribution pipe up until the solenoid-operated fuel-injection valves are out of the hole in the intake manifold. Do not damage the nozzle needle or the rubber gasket.

Check the nozzle needles and the area around them for tightness of seal and for dirt deposits. Disconnect the electrical connection.

Carefully shove the holding bracket out of the slot and pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe connection.

yes



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on K17/K18

Continued on K15/K16

K13

Poor throttle take-up
BMW



K14

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Caution!

Catch any fuel that runs out.
Do not allow it to drip on hot portions of the engine. Fire hazard!

Caution!

The protection sleeve must not be pried off.
Installation of the solenoid-operated fuel-
injection valves

Take out and replace damaged or swollen O-rings.
Use set of parts 1 287 010 704.

Cut the lower O-ring (intake tube) into pieces.

Caution! Do not damage the protection sleeve.

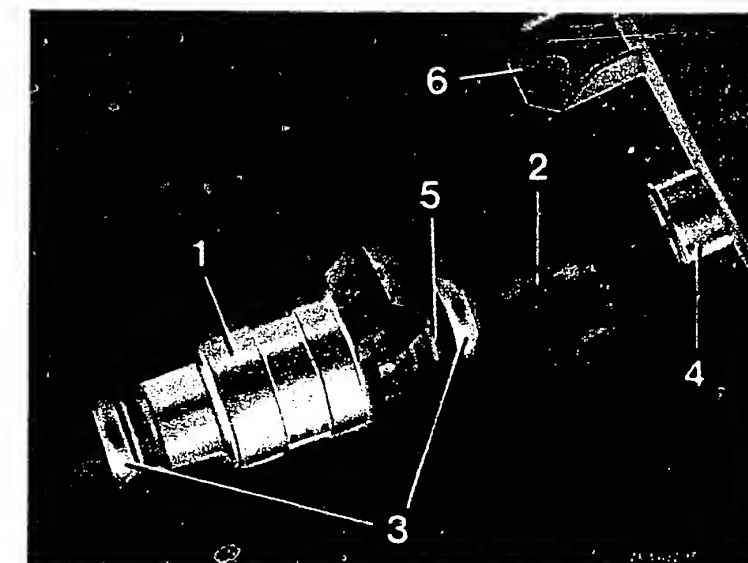
Pull a new O-ring over the protection sleeve and the shoulder on it. Do not damage any parts in so doing.

Before installation, check both rubber gaskets for proper seating. Fasten the solenoid-operated fuel-injection valves to the fuel distribution pipe.

All solenoid-operated fuel-injection valves are to be pressed into the seats at the same time using the fuel distribution pipe. Screw the fuel distribution pipe tight. Check all air and fuel hoses for proper seating.

Make electrical connections.

Start the engine and check that no unmetered air is being drawn in.



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on K17/K18

K15

Poor throttle take-up
BMW



K16

Poor throttle take-up
BMW



Poor throttle take-up (continued)

yes

Is the idle speed control OK?

no

Measure idle actuator winding resistance:
between
term. 1 and term. 2: 19...25 Ω
term. 3 and term. 2: 17...22.5 Ω
In case of interruption or 0 Ω , actuator is defective.
Measure pulses at actuator plug. At idle speed, pulses must be visible on oscilloscope (lower diagram). If there are no pulses: check idle actuator voltage supply (+). Subsequently check leads to Motronic control unit (term. 33, 34); if necessary, replace control unit.
Further causes of trouble:
Actuator mechanically defective, e.g. rotary spool not freely moveable.

yes

Checking the customer complaint

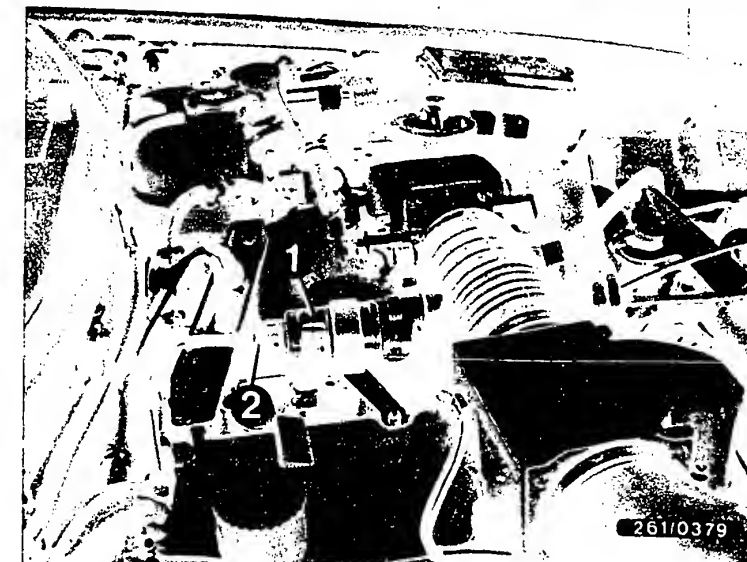
"Poor throttle take-up"

has been completed.
Has the customer complaint been corrected?

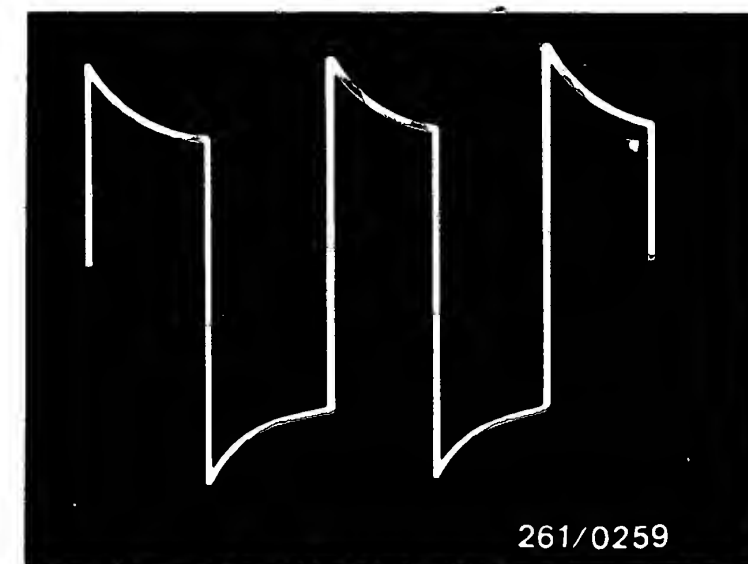
no

Additional possible defects

- The customer complaint has been incorrectly identified. (See Coordinates C3 ... C10.) If the defect has not been identified using the "Targeted Trouble-Shooting", see "Detailed Trouble-Shooting" (Coordinates C3/C4).
- Engine is not O.K. mechanically. (Compression, valve setting, valve timing, wear on camshaft).



1 = Idle actuator
2 = Actuator plug



K17

Poor throttle take-up
BMW



K18

Poor throttle take-up
BMW



ENGINE MISSING IN ALL DRIVING CONDITIONS

Trouble-shooting program according to customer complaint

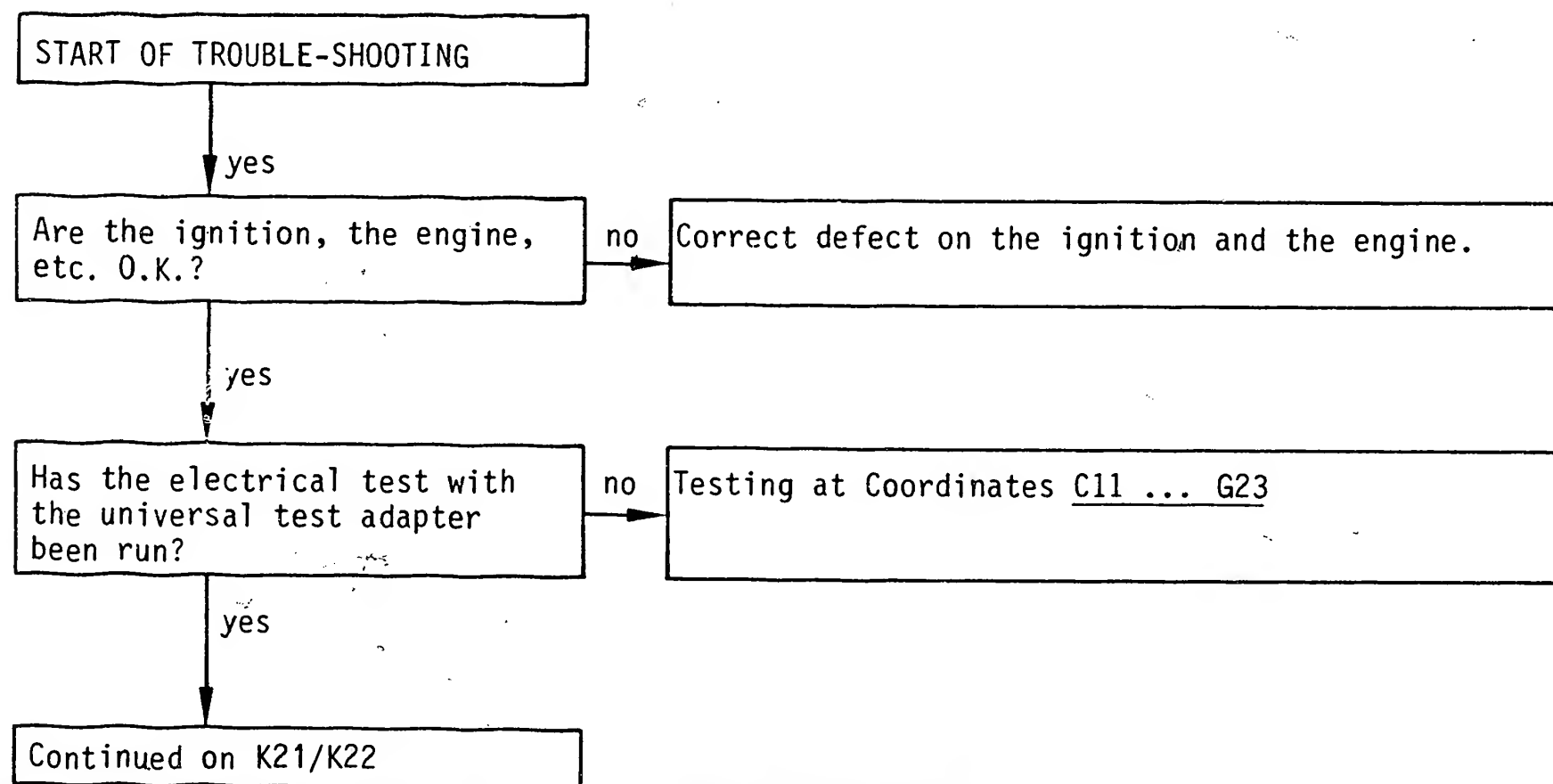
How to use program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



K19

Engine missing in all driving conditions
BMW



K20

Engine missing in all driving conditions
BMW



Engine missing in all driving conditions (continued)

yes

Check the secondary pattern for all cylinders. Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal).

Notes:

Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder numbers! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx 0Ω). Secondary coil resistance: 5 to 7.2 k Ω . Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference-suppression resistance in

Ignition distributor rotor:	1 k Ω
Ignition distributor housings:	each 1 k Ω
Spark-plug connectors:	each 5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

yes

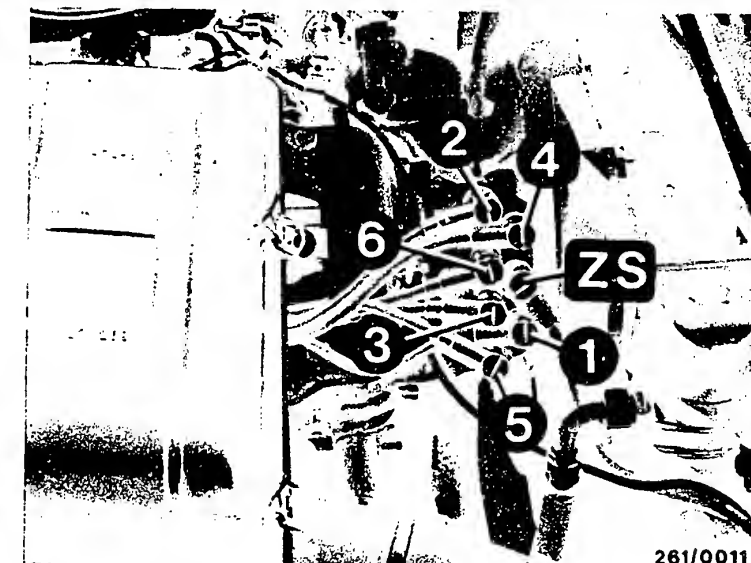
Are the plug connections for the wiring harness and the ground terminal O.K.?

no

Look for engine missing due to loose contacts as follows: have the engine run, if possible on the chassis dynamometer. Hold the engine speed constant and watch for missing. In so doing, move the wiring harness and a plug connection. Pay particular attention to the plug connection at the rotational-speed and reference marker sensors. Is the ground terminal tightened firmly? Check plug connections for correct seating and corrosion. The spring contacts must be latched in and it must not be possible to shove them back! Check the ground leads for continuity and loose contact.

yes

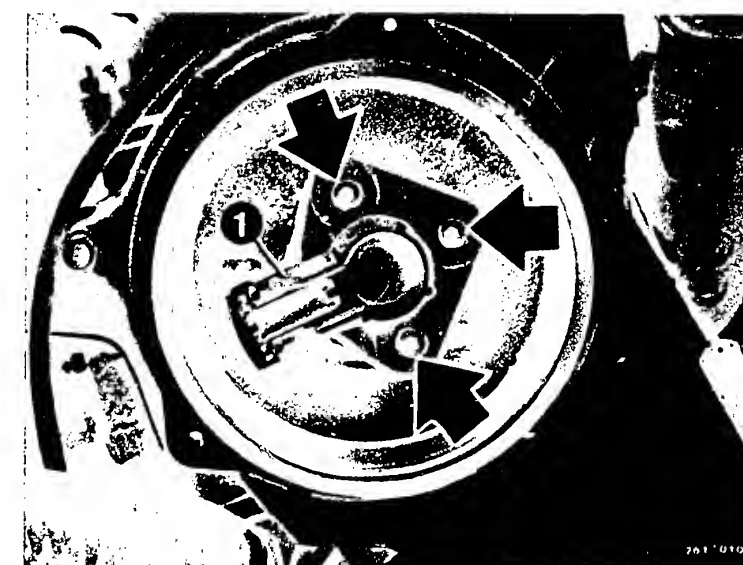
Continued on K23/K24



261/0011

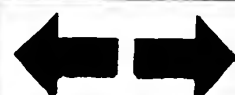
High voltage distributor
1 - 6 = Cylinder numbers
ZS = High voltage lead to the ignition coil

1 = Distributor rotor
Arrow = Fastening screws



K21

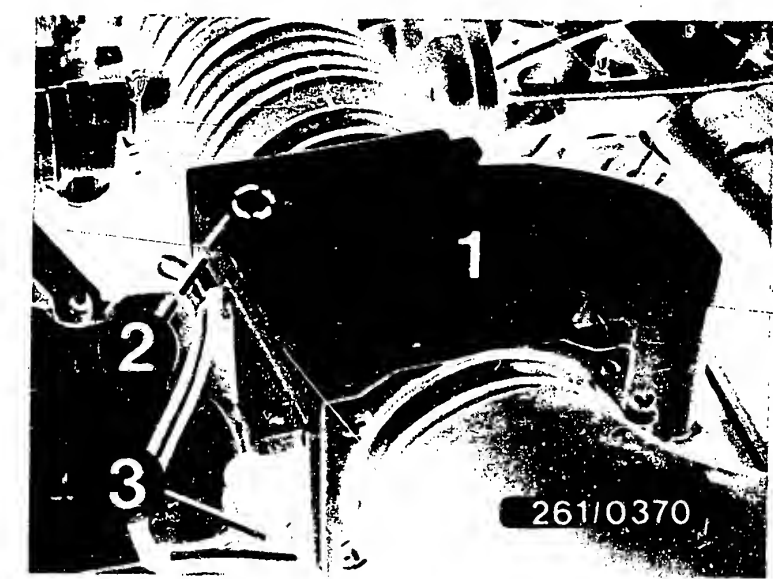
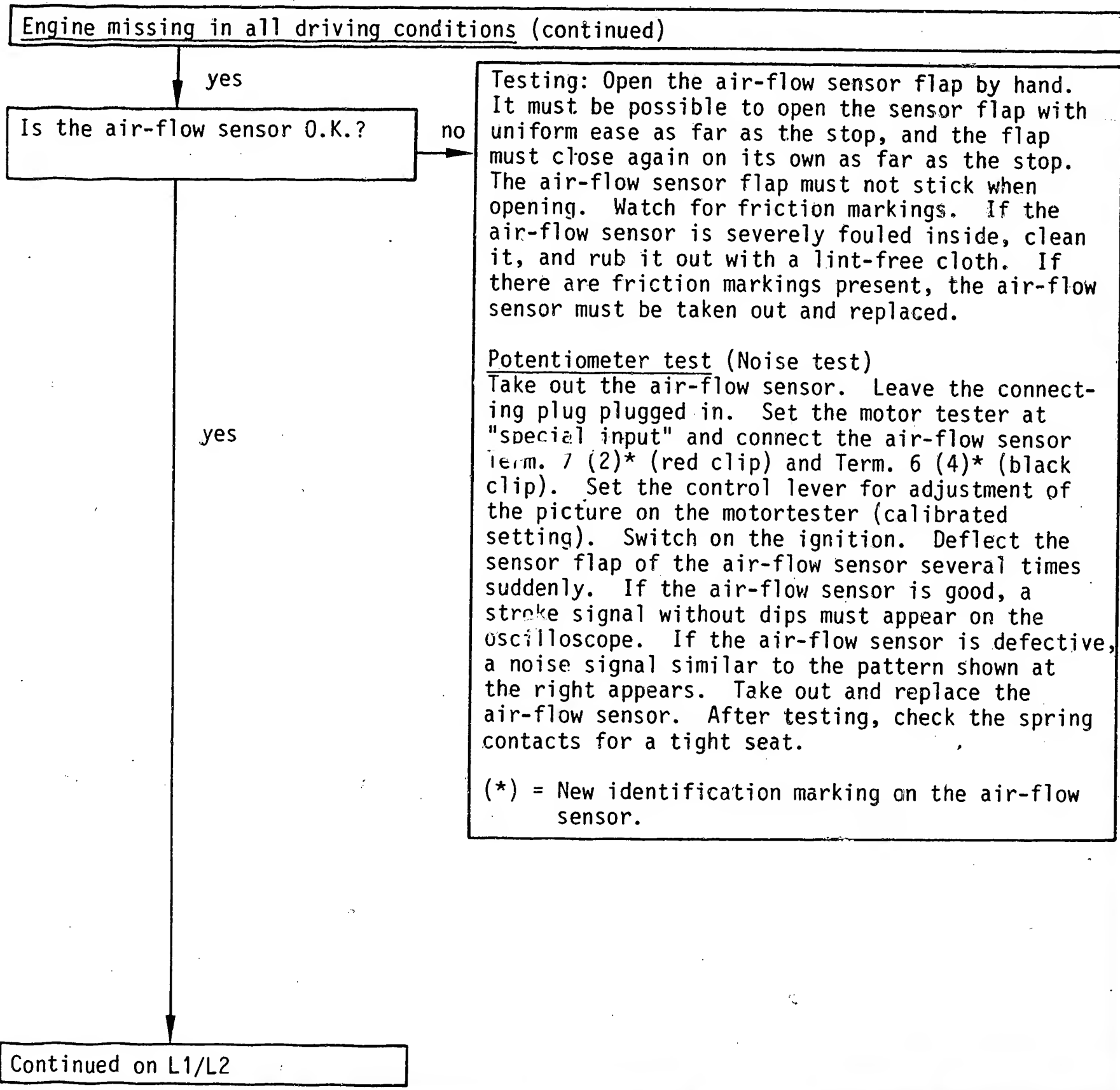
Engine missing in all driving conditions
BMW



K22

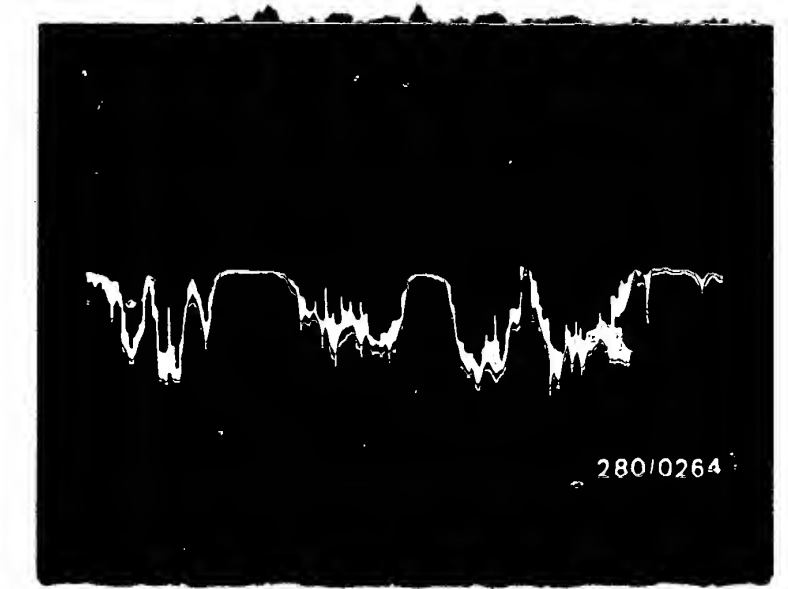
Engine missing in all driving conditions
BMW

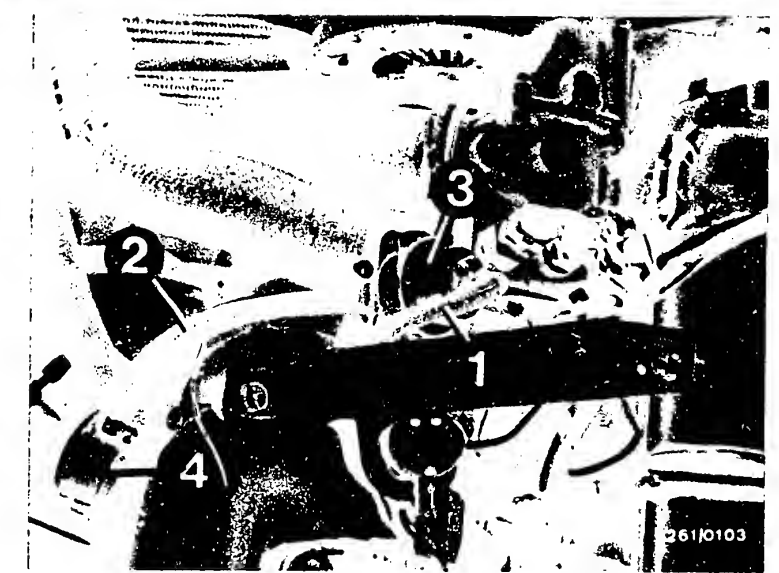
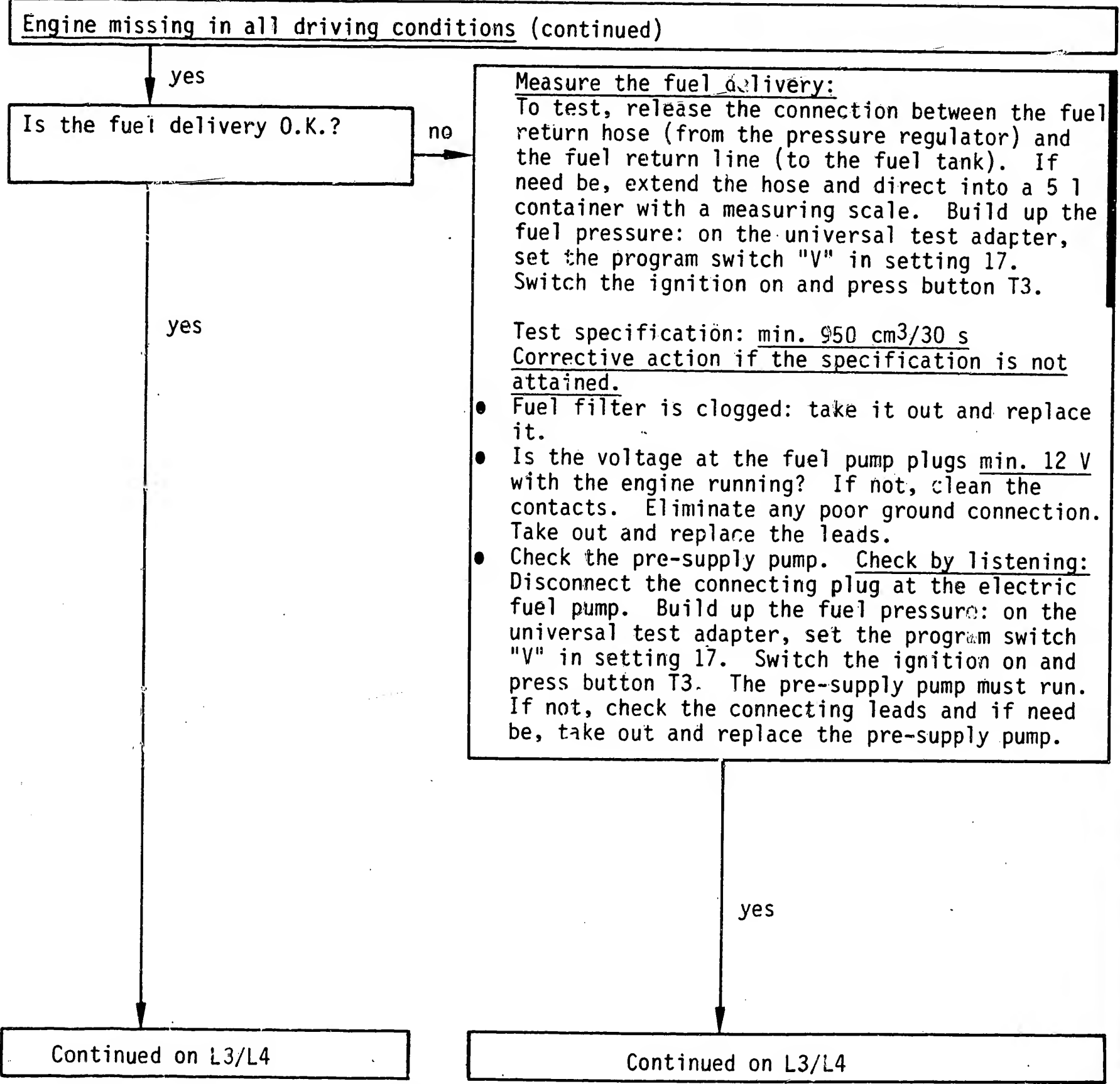




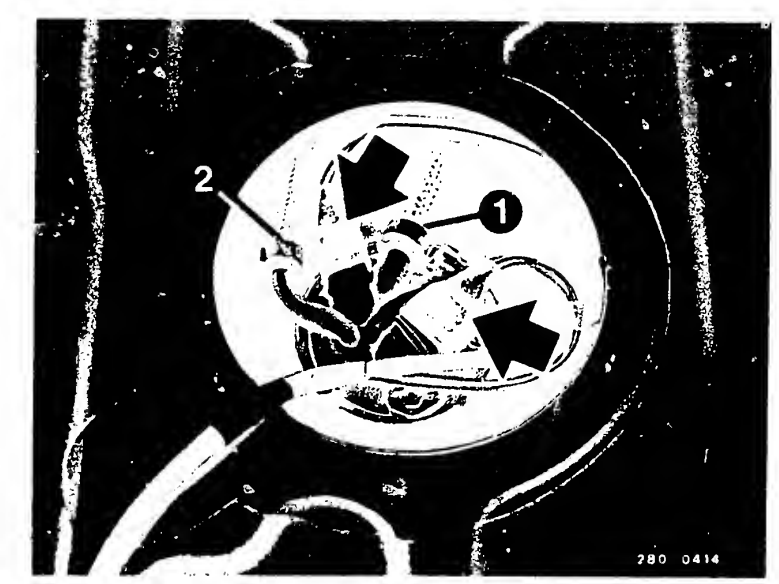
- 1 = Air-flow sensor with NTC I
- 2 = Idle-mixture-adjusting screw
- 3 = Air-flow sensor plug

Noise signal with defective air-flow sensor





- 1 = Air hose to intake manifold
 - 2 = Fuel return line
 - 3 = Pressure regulator
 - 4 = Fuel-line-pressure damper
-
- Pre-supply pump: under the mat in the luggage compartment.
- 1 = Fuel delivery line to the electric fuel pump
 - 2 = Fuel return line
- Arrows = Connection plug, 2-pole; pre-supply pump, 3-pole, immersion tube sensor



Engine missing in all driving conditions (continued)

yes

- The fuel pressure regulator is defective: take it out and replace it. The fuel pressure regulator is fastened to the fuel distribution pipe using two fastening screws and across an O-ring. After the pressure regulator is taken out, the O-ring and the flat ring must be taken out and replaced. (Use set of parts 1 287 010 704).
- The fuel pump output is too low: take out and replace the fuel pump.
- Is the filter in the tank clogged? Is there corrosion in the tank?

Does the engine cough on over-run?

no

1. Check the exhaust system for leaks.
2. Is the throttle valve closed?
Find out whether the throttle valve can be closed even further, causing the engine speed to drop off.
Visual inspection:
Release the hose clamp and remove the hose at the throttle-valve assembly. Has the throttle valve been set for a gap? If need be, make correction at the idle stop screw. After a correction, readjust the accelerator cable.

yes

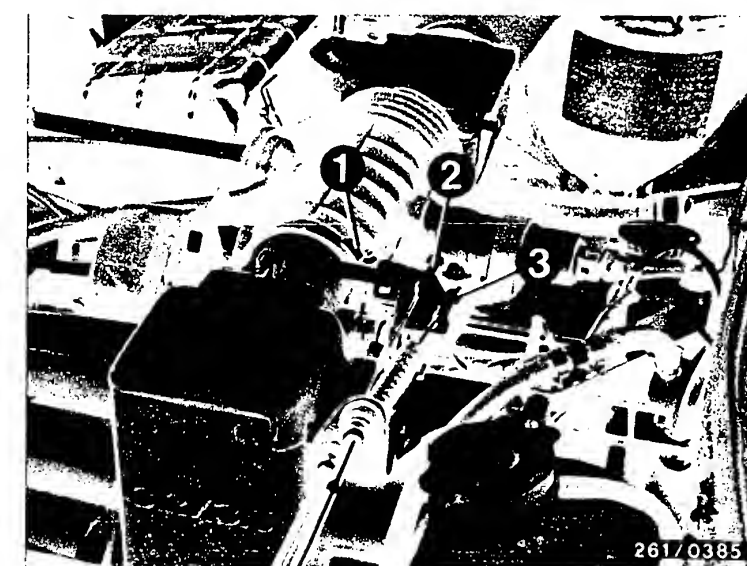
Continued on L5/L6

Continued on L5/L6



- 1 = Air hose to intake manifold
- 2 = Fuel return line
- 3 = Pressure regulator
- 4 = Fuel-line-pressure damper

- 1 = Hose clamp
- 2 = Bowden cable to accelerator pedal
- 3 = Bowden cable to road-speed regulator



L3

Engine missing in all driving conditions
BMW



L4

Engine missing in all driving conditions
BMW



Engine missing in all driving conditions (continued)

yes

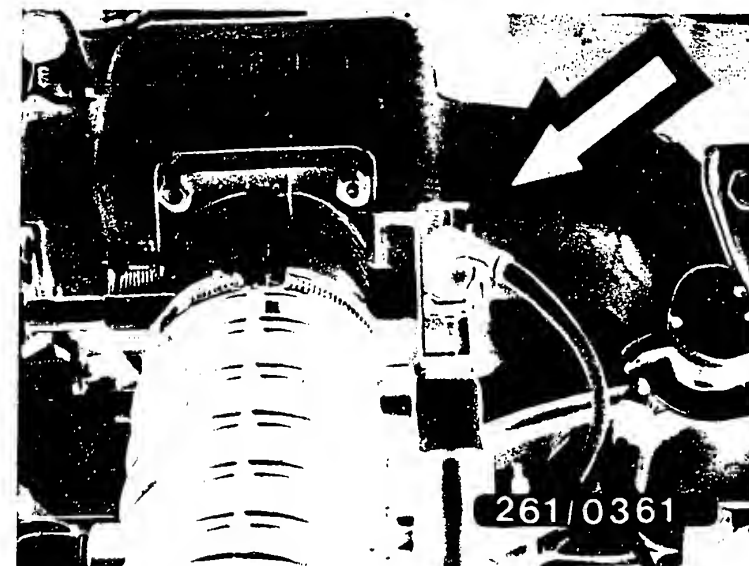
Adjustment of the throttle-valve switch:
Release the fastening screws somewhat.
Connect an ohmmeter to the throttle-valve switch Term. 2 and ground. Turn the control lever to "full throttle" and slowly return it to the idle stop.
Turn the throttle-valve switch until the internal stop becomes perceptible. (Reading: 0Ω).

Checking the setting:
Pull on the accelerator cable somewhat. The idle contact must switch audibly. (Reading: $\infty\Omega$).

Note:

With vehicles having electronic transmission control, check also voltage at potentiometer tap (see lower picture).

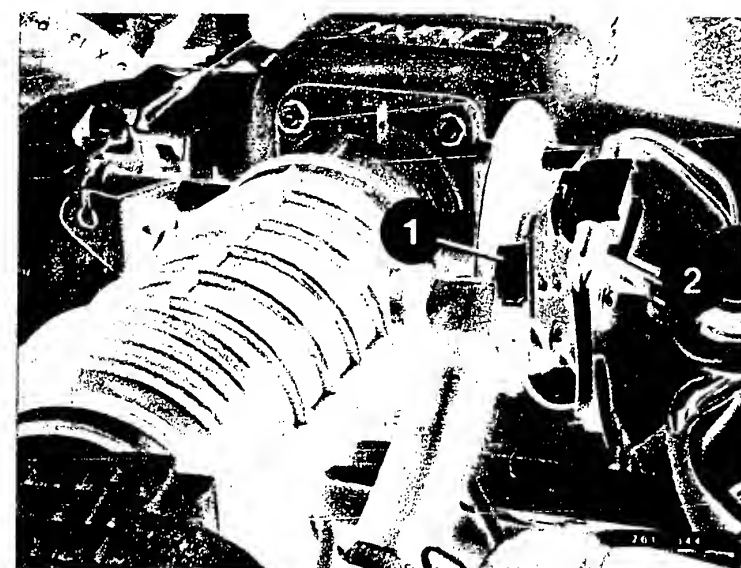
Nominal value in idle: $0.9 \pm 0.1 \text{ V}$



Arrow = Throttle-valve switch

Vehicles with electronic transmission control

- 1 = Microswitch (idle contact)
- 2 = Potentiometer (no full-load contact) (1 and 2 under rubber cap)



Is the control unit O.K.?

no

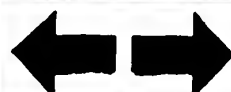
Have the engine run. Shake the control unit lightly and move the control unit plug. Watch for engine missing. Correct the plug connection on the control unit plug or take out and replace a defective control unit.

yes

Continued on L7/L8

L5

Engine missing in all driving conditions
BMW

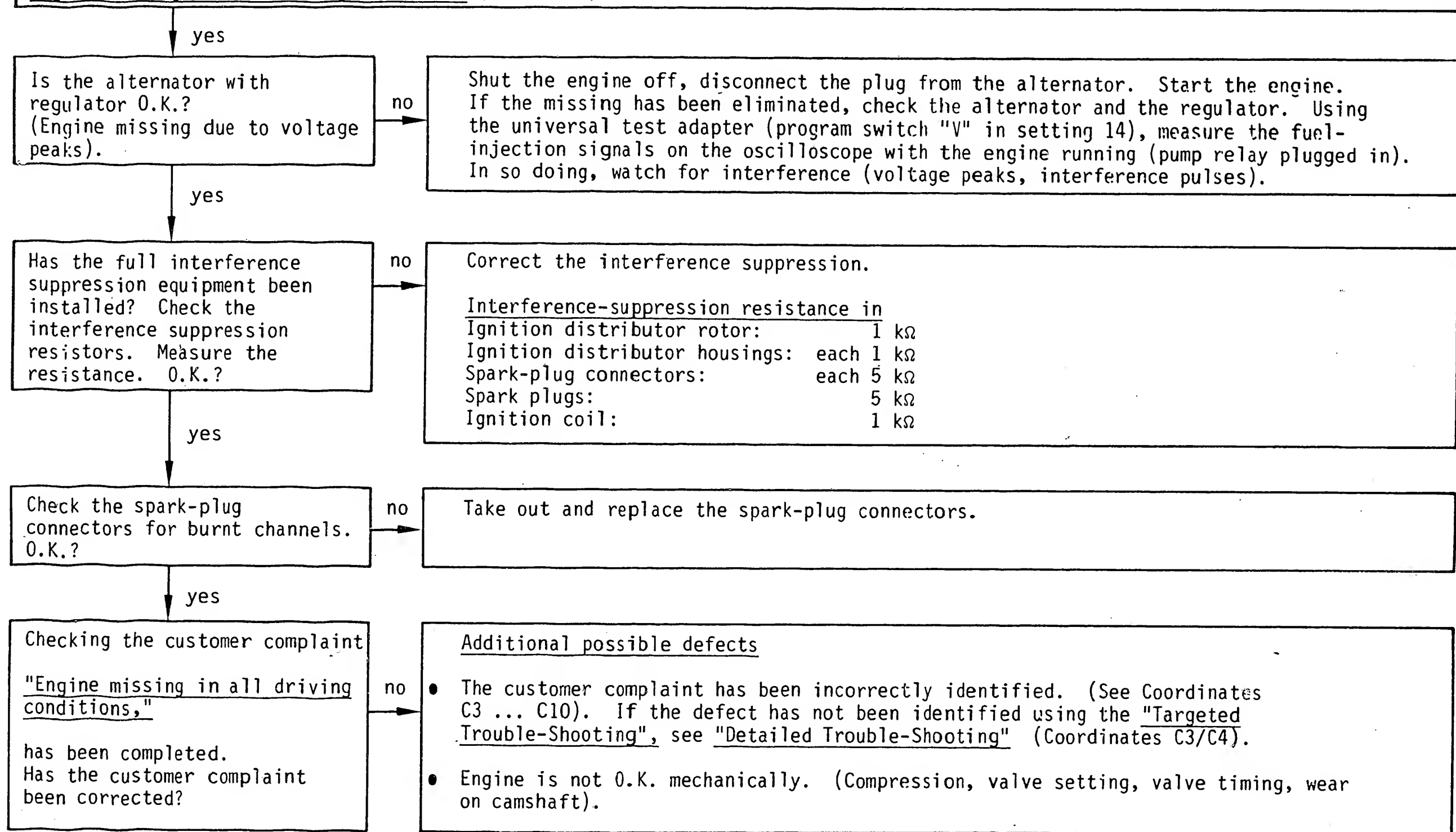


L6

Engine missing in all driving conditions
BMW



Engine missing in all driving conditions (continued)



L7

Engine missing in all driving conditions
BMW



L8

Engine missing in all driving conditions
BMW



POOR MILEAGE

Trouble-shooting program according to customer complaint

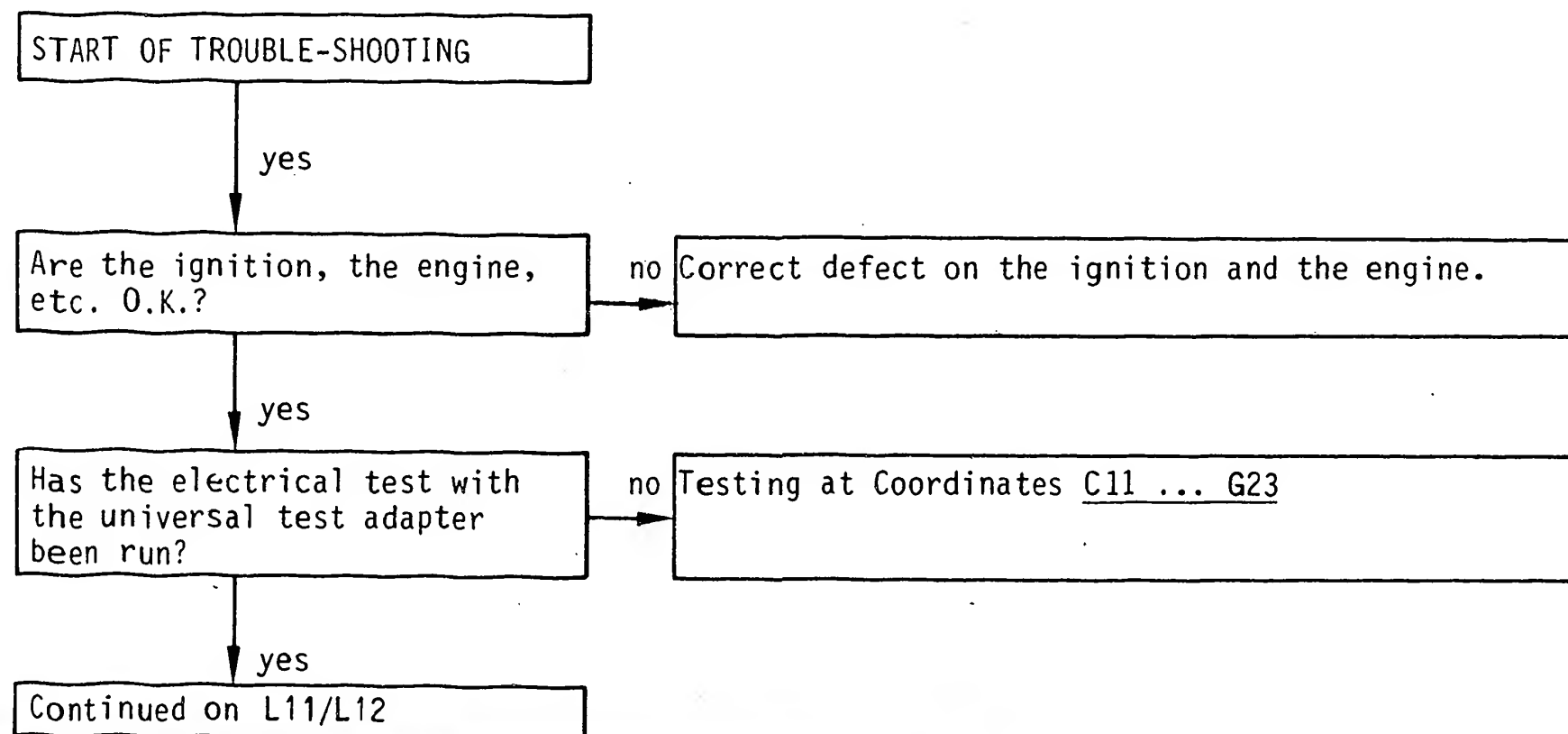
How to use the program

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If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



L9

Poor mileage
BMW



L10

Poor mileage
BMW



Poor mileage (continued)

yes

Check the secondary pattern for all cylinders. Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal.)

Notes:

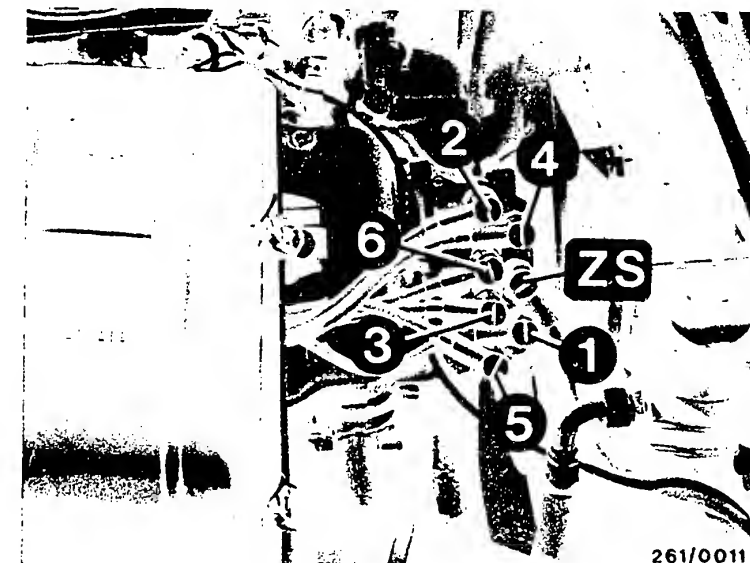
Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder numbers! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx. 0Ω). Secondary coil resistance: 5 to 7.2 k Ω . Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference-suppression resistance in

Ignition distributor rotor:	1 k Ω
Ignition distributor housings:	each 1 k Ω
Spark-plug connectors:	each 5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

yes

Continued on L13/L14



261/0011

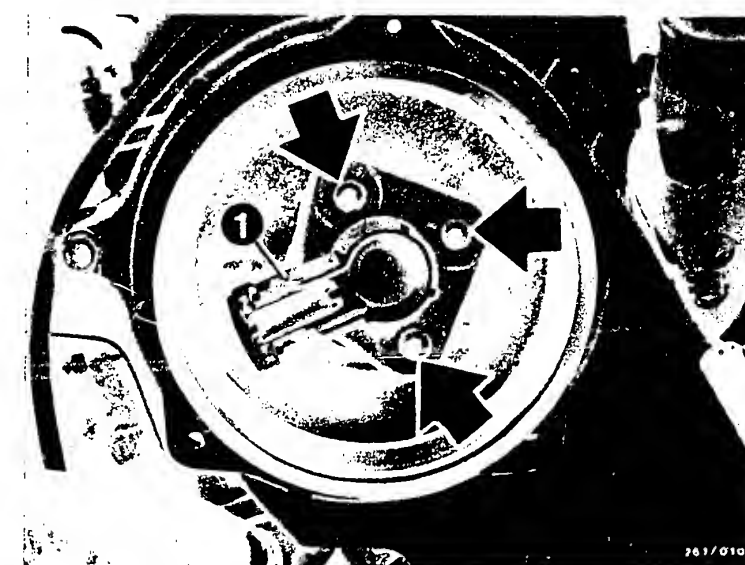
High voltage distributor

1 - 6 = Cylinder numbers

ZS = High voltage lead to the ignition coil

1 = Distributor rotor

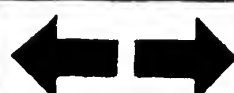
Arrow = Fastening screws



261/0105

L11

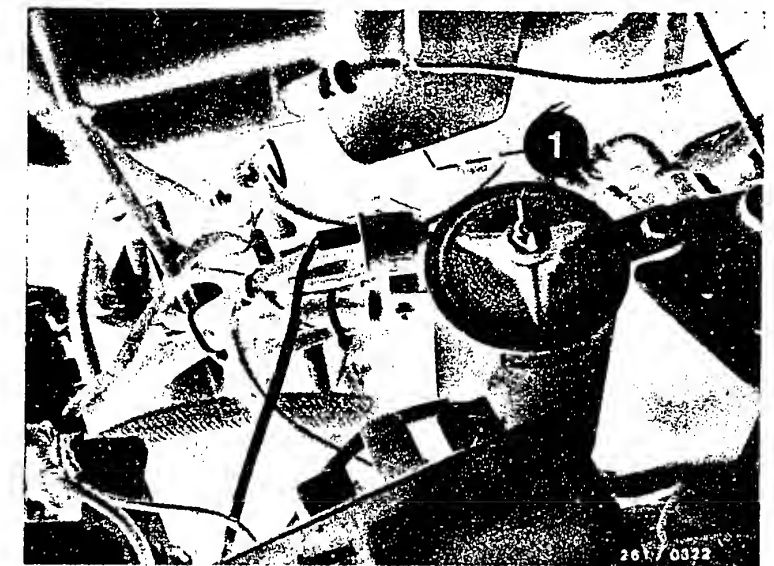
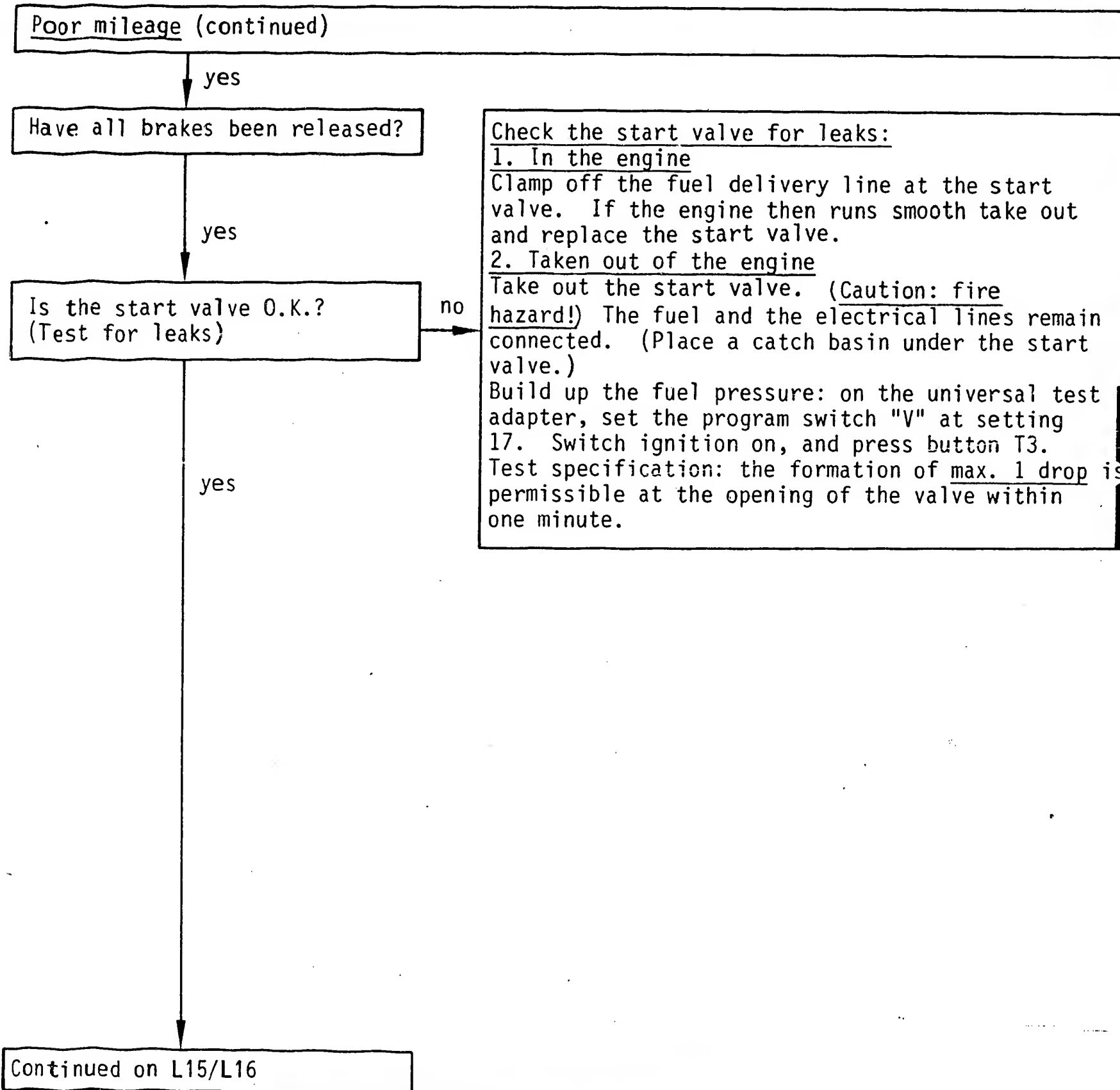
Poor mileage
BMW



L12

Poor mileage
BMW





1 = Start valve (below on intake manifold)

L13

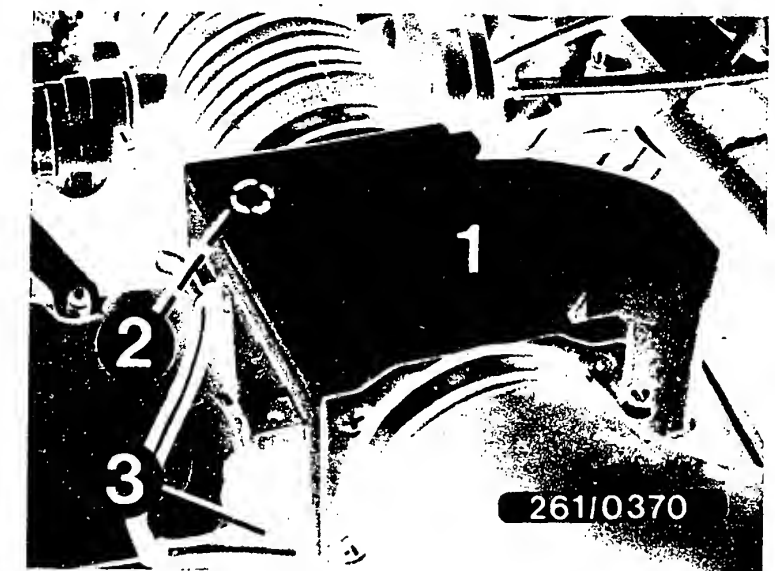
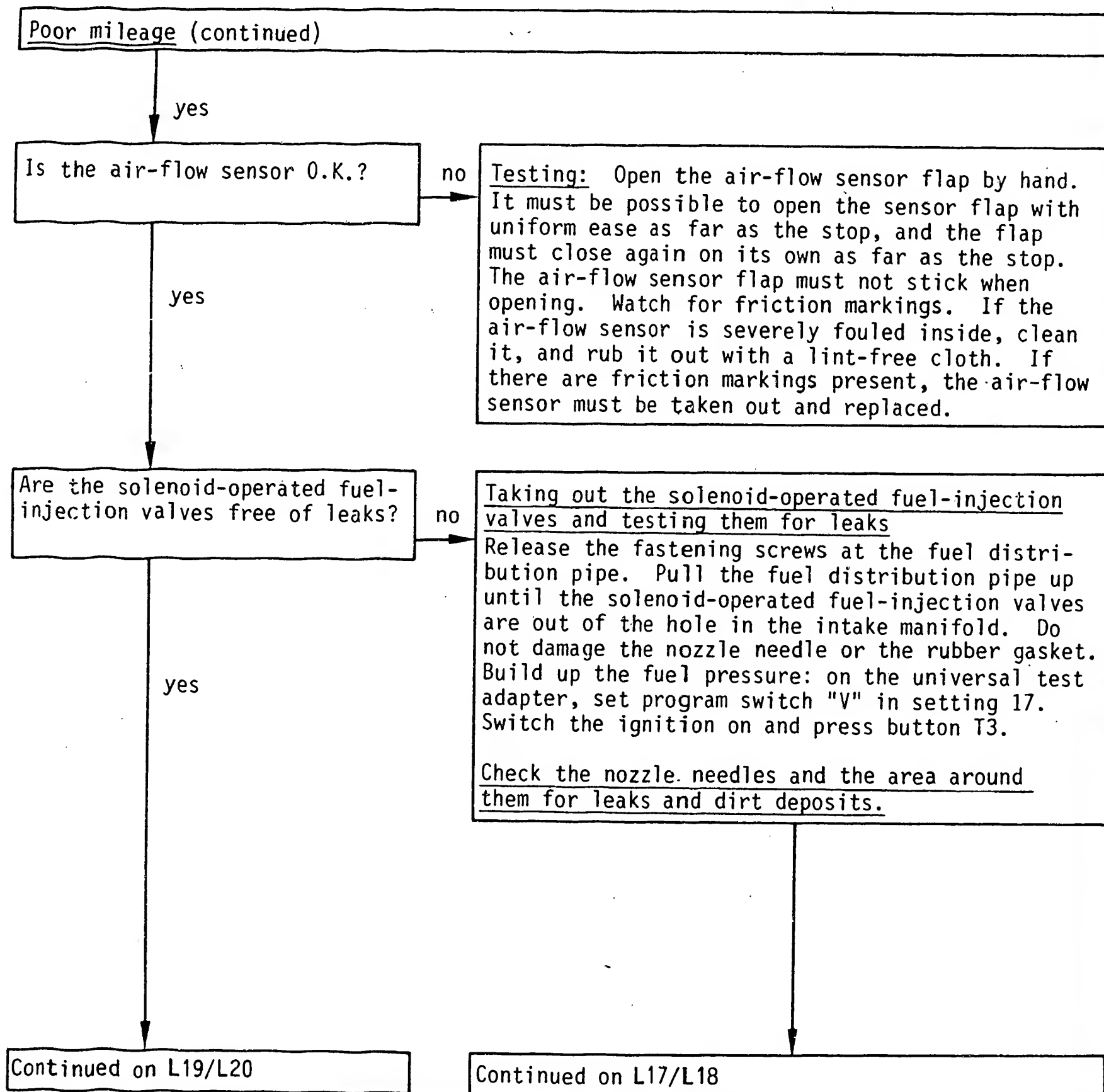
Poor mileage
BMW



L14

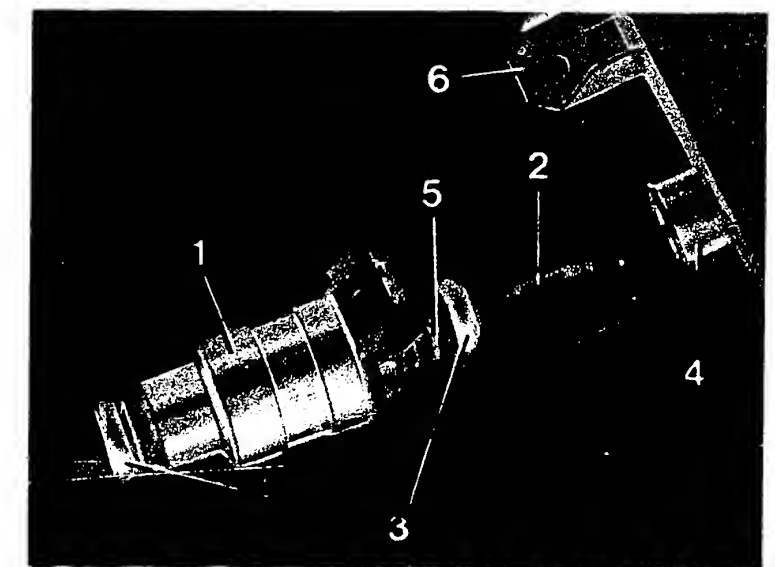
Poor mileage
BMW





- 1 = Air-flow sensor with NTC I
- 2 = Idle-mixture-adjusting screw
- 3 = Air-flow sensor plug

- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket (O-ring)
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab



L15

Poor mileage
BMW



L16

Poor mileage
BMW



Poor mileage (continued)

yes

Disconnect the electrical connection.

Shove the holding bracket carefully out of the slot and pull the solenoid-operated fuel-injection valve out of the fuel distribution pipe connection.

Caution!

Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine. Fire hazard!

Caution!

The protection sleeve must not be pried off.

Installation of the solenoid-operated fuel-injection valves

Take out and replace damaged or swollen O-rings. Use set of parts 1 287 010 704.

Cut the lower O-ring (intake tube) into pieces.

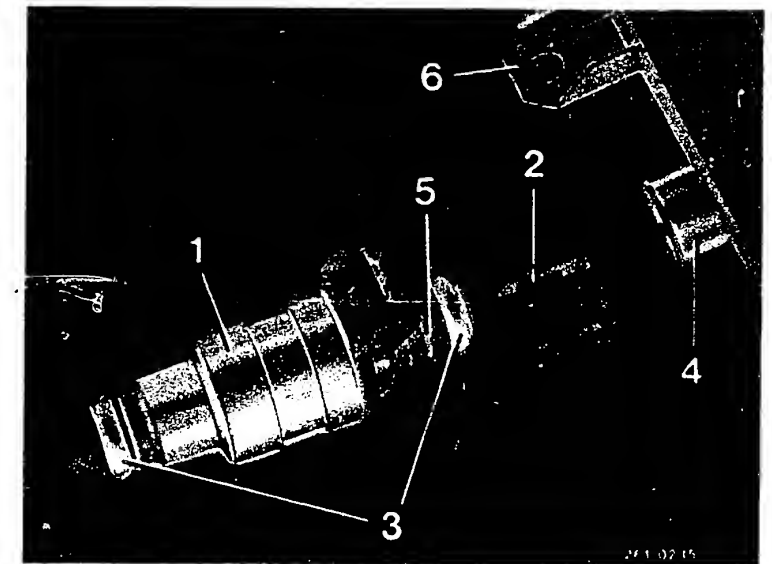
Caution! Do not damage the protection sleeve.

Pull a new O-ring over the protection sleeve and the shoulder on it. Do not damage any parts in so doing.

Before installation, check both rubber gaskets for proper seating. Fasten the solenoid-operated fuel-injection valves to the fuel distribution pipe. All solenoid-operated fuel-injection valves are to be pressed into the seats at the same time using the fuel distribution pipe. Screw the fuel distribution pipe tight. Check all air and fuel hoses for proper seating.

Make electrical connections.

Start the engine and check that no unmetered air is being drawn in.



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on L19/L20

L17

Poor mileage
BMW



L18

Poor mileage
BMW



Poor mileage (continued)

yes

CO value OK?

Test specification:
0.2...1.2 vol. % CO

Measure before cat. converter,
plug connection from lambda
sensor separated.

Engine at operating temperature
and all electric loads switched
off.

Idle speed
750...850 min⁻¹

no

- For exhaust-gas adjustment remove vent plugs in air-flow sensor with special tool and adjust mixture-adjusting screw.
Right turn: CO value rises.
Left turn: CO value falls.
Subsequently use new vent plugs.

- If CO not adjustable and mixture too lean:
Repeat leakage test of induction system.
Mixture too rich:
Repeat measurement and adjustment with crankshaft housing vent hose disconnected, otherwise check air-flow sensor

yes

Testing completed for customer
complaint

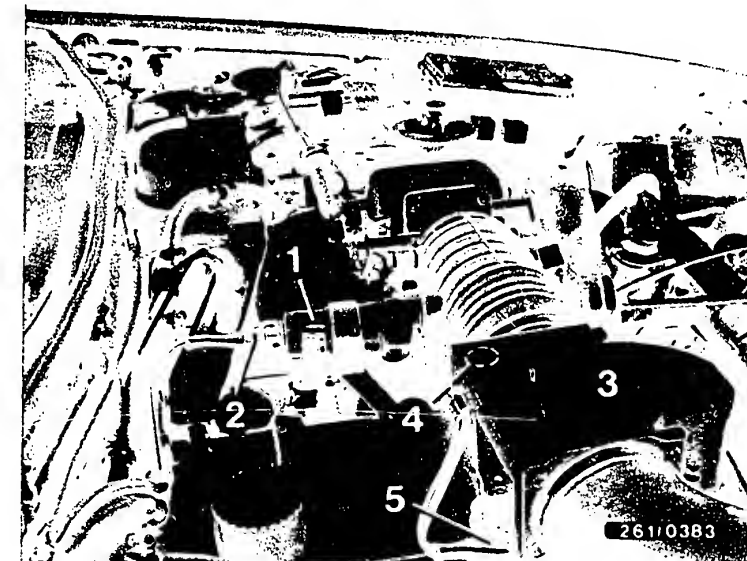
"Poor mileage"

Customer complaint remedied?

no

Further possibilities

- Customer complaint incorrectly diagnosed (see coordinates C3...C10). If the fault was not detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not in good mechanical order (compression, valve setting, valve timing, worn camshaft).



- 1 = Idle actuator
- 2 = Actuator plug
- 3 = Air-flow sensor with NTC-I
- 4 = Idle-mixture-adjusting screw
- 5 = Air-flow sensor plug

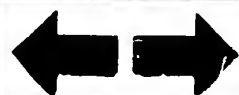
- 1 = CO connection before catalytic converter (cyl. 4, 5, 6)
- 2 = Plug connection from lambda sensor



L19

Poor mileage

BMW



L20

Poor mileage

BMW



NO MAX. ENGINE POWER, AND/OR MAX. VELOCITY

Trouble-shooting program according to customer complaint

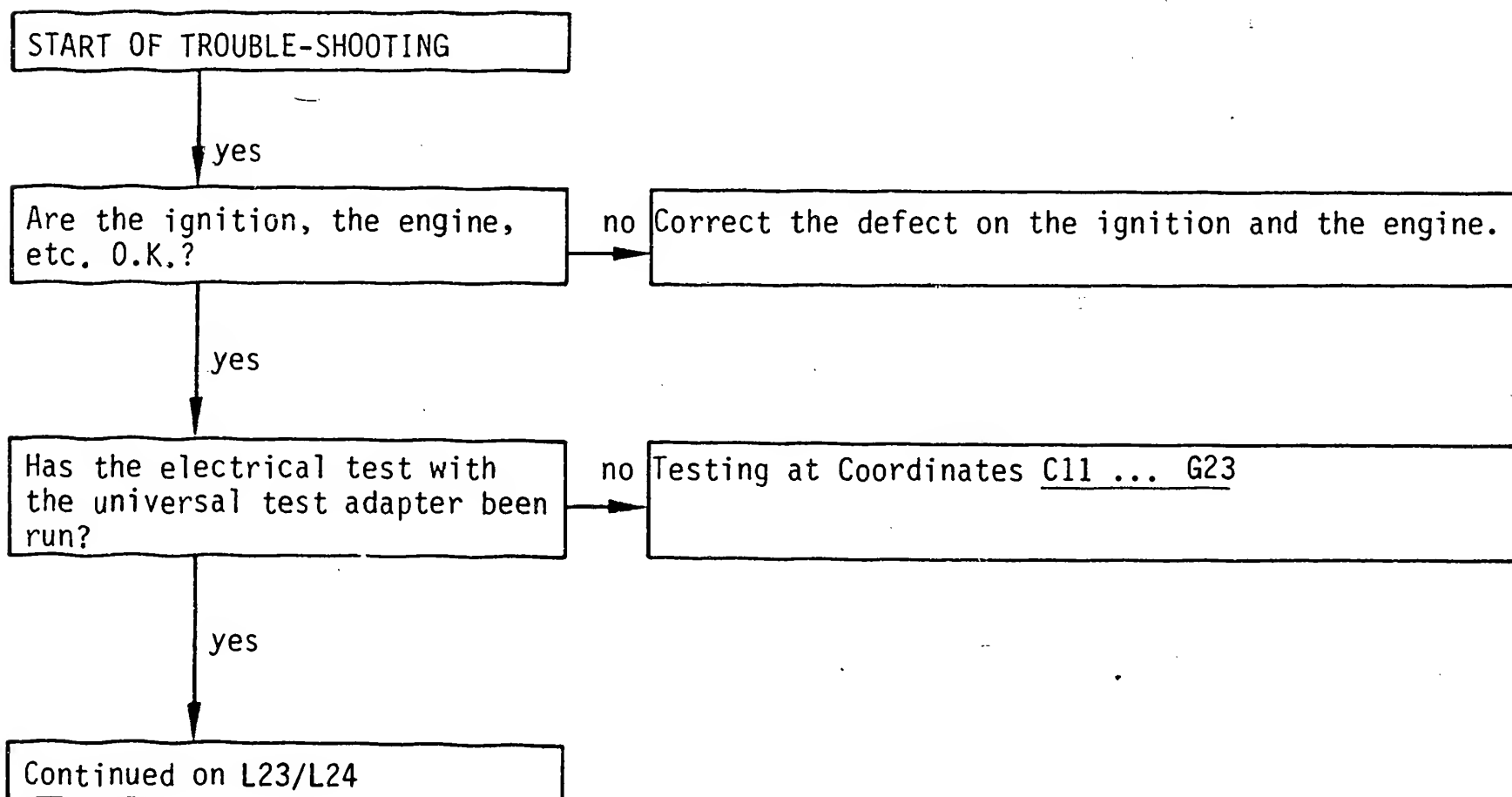
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



L21

No max. engine power

BMW

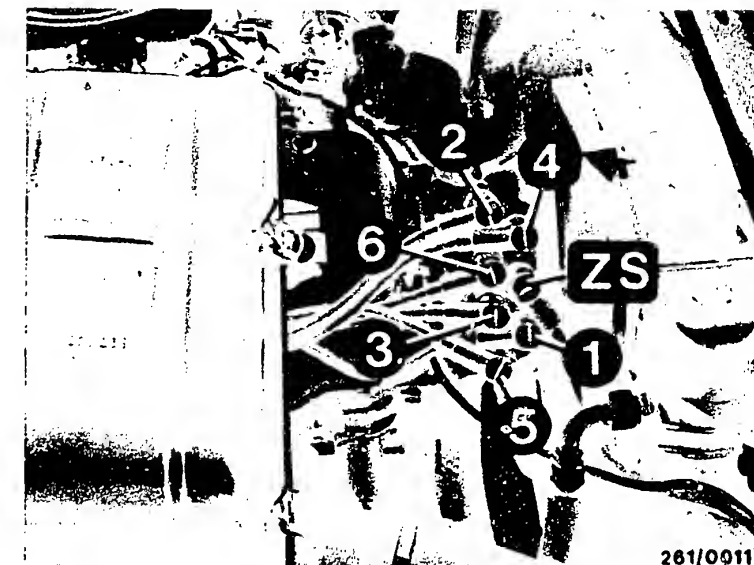
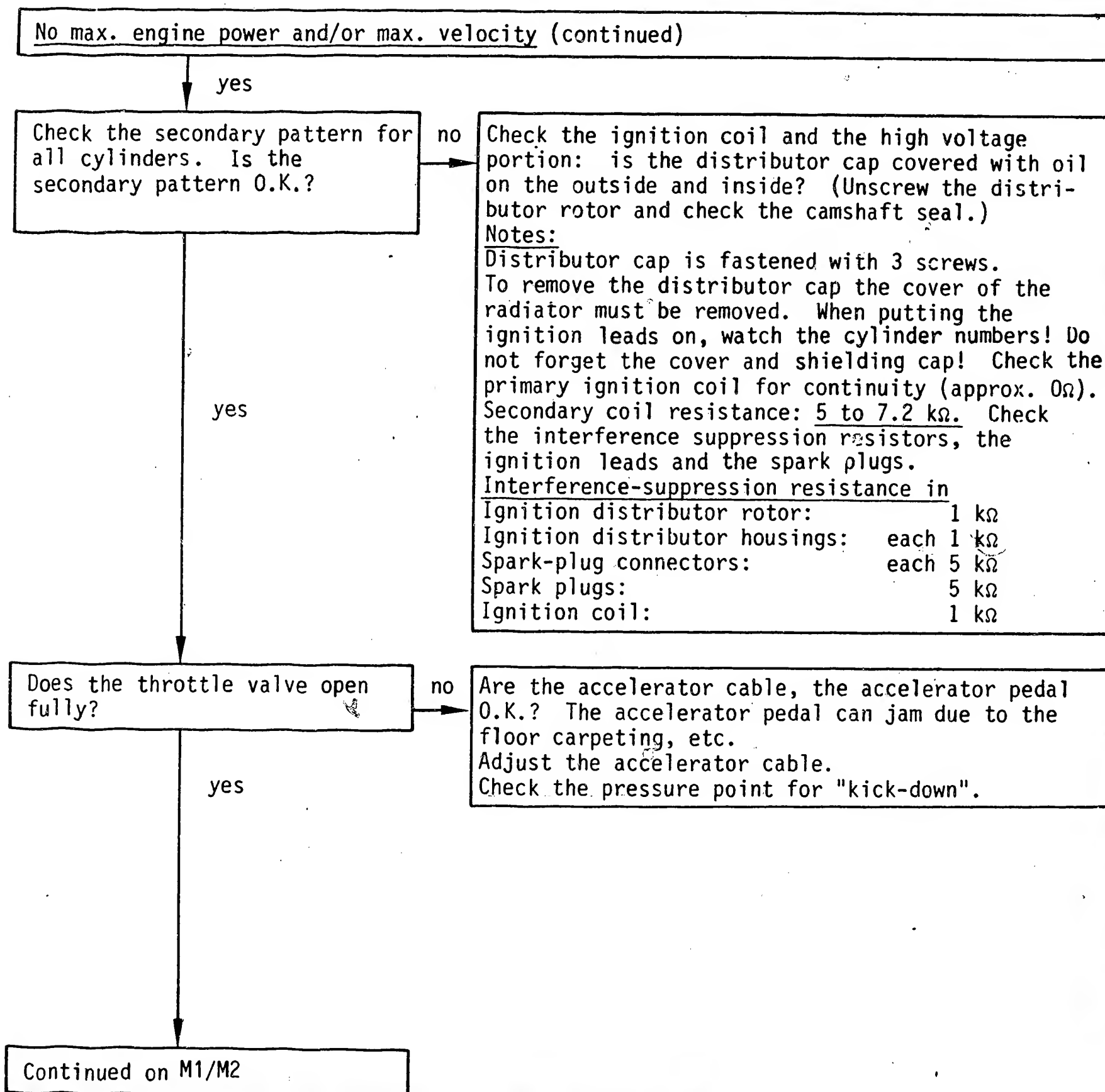


L22

No max. engine power

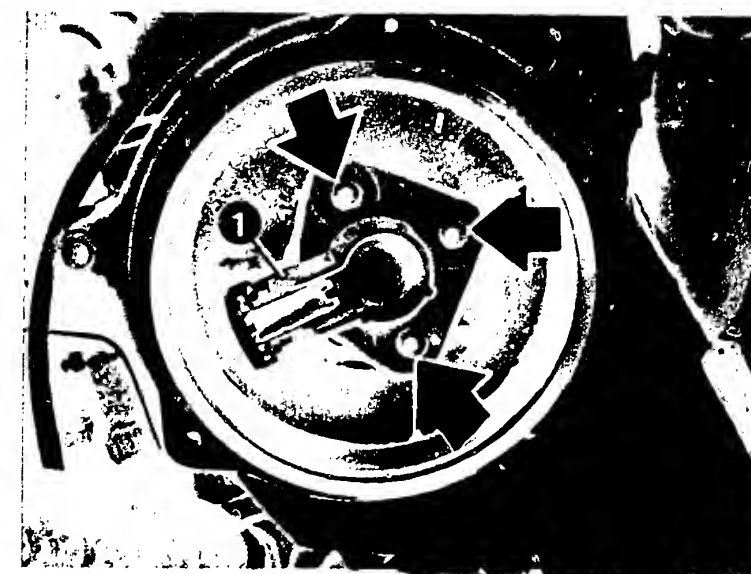
BMW





High voltage distributor
1 - 6 = Cylinder numbers
ZS = High voltage lead to the ignition coil

1 = Distributor rotor
Arrow = Fastening screws



L23

No max. engine power

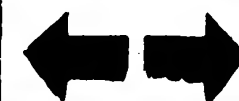
BMW



L24

No max. engine power

BMW



No max. engine power and/or max. velocity (continued)

yes

Is the air-flow sensor O.K.?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and the flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for friction markings. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are friction markings present, the air-flow sensor must be taken out and replaced.

yes

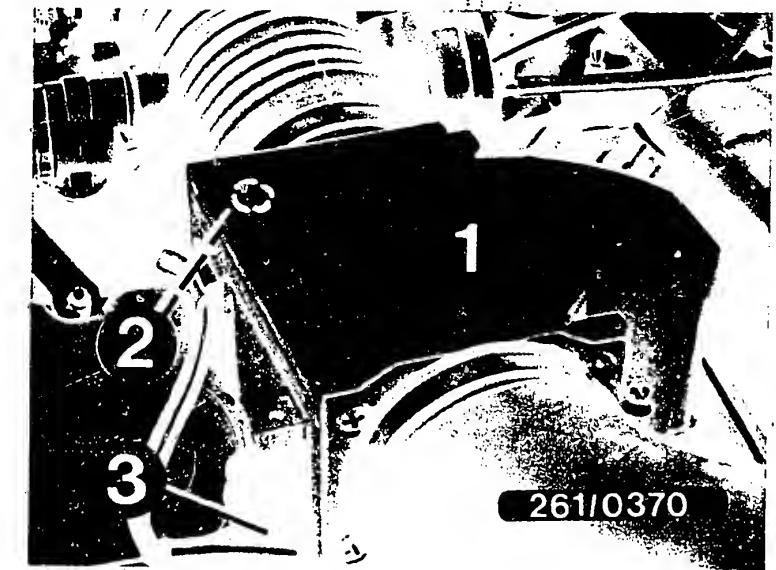
Air intake path open?

no

Air filter is clogged.

yes

Continued on M3/M4



1 = Air-flow sensor with NTC I
2 = Idle-mixture-adjusting screw

M1

No max. engine power
BMW



M2

No max. engine power
BMW



No max. engine power and/or max. velocity (continued)

yes

Are solenoid-operated fuel-injection valve O.K. mechanically?

no

The solenoid-operated fuel-injection valves can be clogged due to dirt deposits.

yes

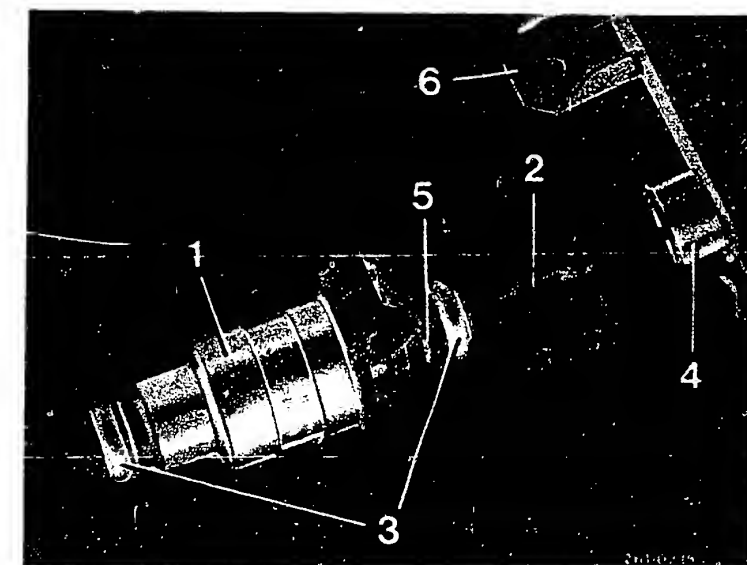
Taking out the solenoid-operated fuel-injection valves

Release the fastening screws on the fuel distribution pipe. Pull the fuel distribution pipe up until the solenoid-operated fuel-injection valves are out of the hole in the intake manifold. Do not damage the nozzle needles or the rubber gasket.

Check the nozzle needles and the area around them for tightness of seal and for dirt deposits.

Disconnect the electrical connection.

Carefully shove the holding bracket out of the slot and pull the solenoid-operated fuel-injection valve out of the fuel-distribution pipe connection.



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on M7/M8

Continued on M5/M6

M3

No max. engine power

BMW



M4

No max. engine power

BMW



No max. engine power and/or max. velocity (continued)

Caution!

Catch any fuel that runs out. Do not allow it to drip on hot portions of the engine. Fire hazard!

Caution!

The protection sleeve must not be pried off.

Installation of the solenoid-operated fuel-injection valves

Take out and replace damaged or swollen O-rings.

Use set of parts 1 287 010 704.

Cut the lower O-ring (intake tube) into pieces.

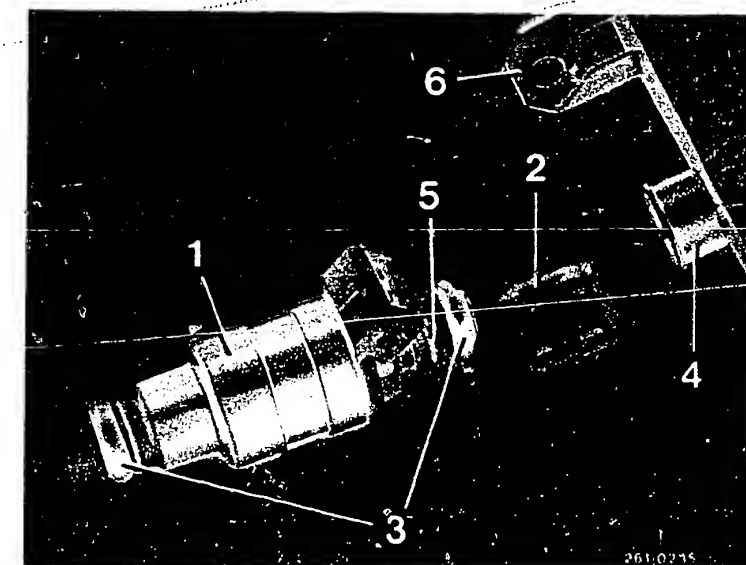
Caution! Do not damage the protection sleeve.

Pull a new O-ring over the protection sleeve and the shoulder on it. Do not damage any parts in so doing.

Before installation, check both rubber gaskets for proper seating. Fasten the solenoid-operated fuel-injection valves to the fuel distribution pipe. All solenoid-operated fuel-injection valves are to be pressed into the seats at the same time using fuel distribution pipe. Screw the fuel distribution pipe tight. Check all air and fuel hoses for proper seating. Make electrical connections.

Start the engine and check that no unmetered air is being drawn in.

yes



- 1 = Solenoid-operated fuel-injection valve
- 2 = Holding bracket
- 3 = Rubber gasket (O-ring)
- 4 = Fuel distribution pipe connection
- 5 = Slot
- 6 = Fastening tab

Continued on M7/M8

M5

No max. engine power
BMW



M6

No max. engine power
BMW



No max. engine power and/or max. velocity (continued)

yes

Is the fuel delivery O.K.?

no

Measure the fuel delivery:

To test, release the connection between the fuel return hose (from the pressure regulator) and the fuel return line (to the fuel tank). If need be, extend the hose and direct into a 5 l container with measuring scale. Build up the fuel pressure: on the universal test adapter set the program switch "V" in setting 17. Switch the ignition on and press button T3.

Test specification: min. 950 cm³/30 s

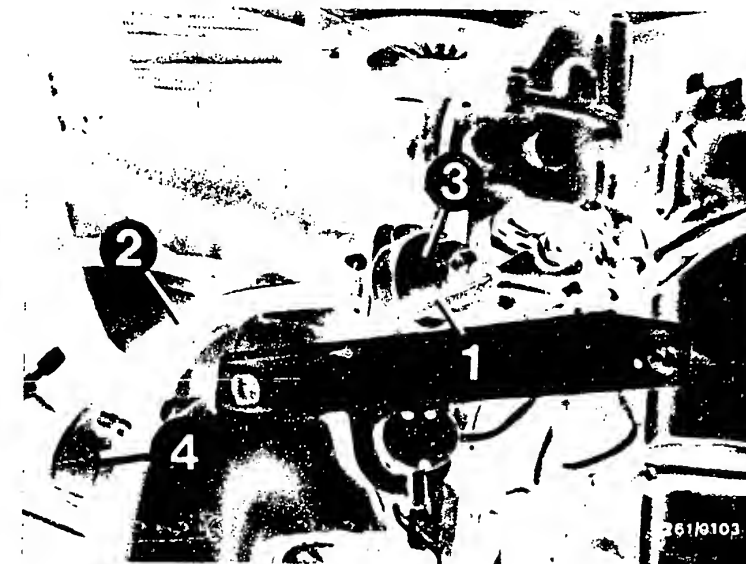
Corrective action if the specification is not attained.

- Fuel filter is clogged: take it out and replace it.
- Is the voltage at the fuel pump plugs min. 12 V with the engine running? If not, clean the contacts. Eliminate any poor ground connection. Take out and replace the leads.
- Check the pre-supply pump. Check by listening: Disconnect the connecting plug at the electric fuel pump. Build up the fuel pressure: on the universal test adapter, set the program switch "V" in setting 17. Switch the ignition on and press button T3. The pre-supply pump must run. If not, check the connecting leads and if need be, take out and replace the pre-supply pump.

yes

Continued on M9/M10

Continued on M9/M10



- 1 = Air hose to intake manifold
- 2 = Fuel return line
- 3 = Pressure regulator
- 4 = Fuel-line-pressure damper

- 1 = Fuel delivery line to the electric fuel pump
- 2 = Fuel return line
- Arrows = Connection plug, 2-pole; pre-supply pump, 3-pole, immersion



M7

No max. engine power

BMW



M8

No max. engine power

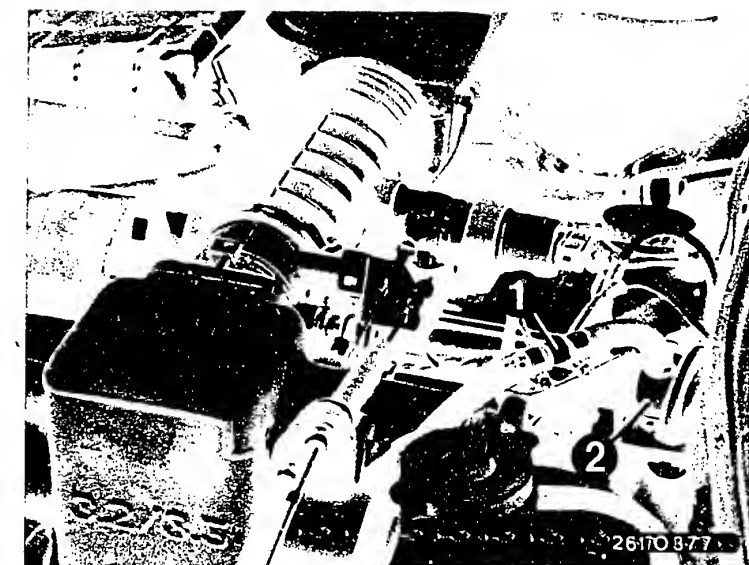
BMW



No max. engine power and/or max. velocity (continued)

yes

- The fuel pressure regulator is defective: take it out and replace it.
The fuel pressure regulator is fastened to the fuel distribution pipe using two fastening screws and across an O-ring. After the pressure regulator is taken out, the O-ring and the flat ring must be taken out and replaced. (Use set of parts 1 287 010 704).
- The fuel pump output is too low: take out and replace the fuel pump.
- Is the filter in the tank clogged? Is there corrosion in the tank?



1 = Connection for pressure gauge
2 = Fuel-line-pressure damper in fuel-pressure line

1 = Electric fuel pump
2 = Fuel spinner
3 = Fuel intake line
4 = Fuel delivery line
5 = Fuel-line-pressure damper
Arrows = Direction of fuel flow

Is the fuel pressure at full load O.K.?

no

Put a pressure gauge into the fuel distribution pipe (delivery line).

Caution:

Catch any gasoline that runs out. Fire hazard with engine hot and electrical sparks!

Have engine run at idle: fuel pump pressure approx. 2.5 bar.

Disconnect the air hose to the intake manifold at the pressure regulator:

Fuel pump pressure: 2.8 ... 3.2 bar.
(The reading may fluctuate slightly.)

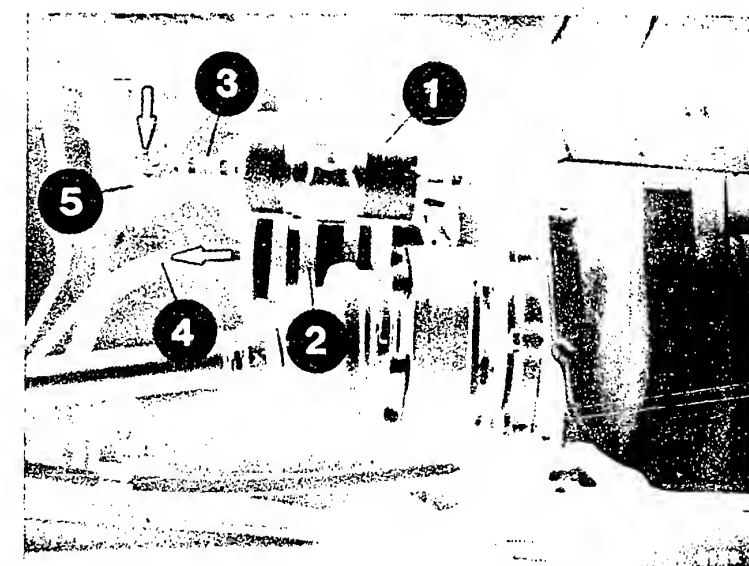
Plug the air hose back on. Check the fuel pressure at nominal engine speed and nominal power output on the chassis dynamometer:

Fuel pressure at full load:
2.8 ... 3.2 bar. (Reading may fluctuate slightly.)

yes

Continued on M13/M14

Continued on M11/M12



M9

No max. engine power
BMW



M10

No max. engine power
BMW

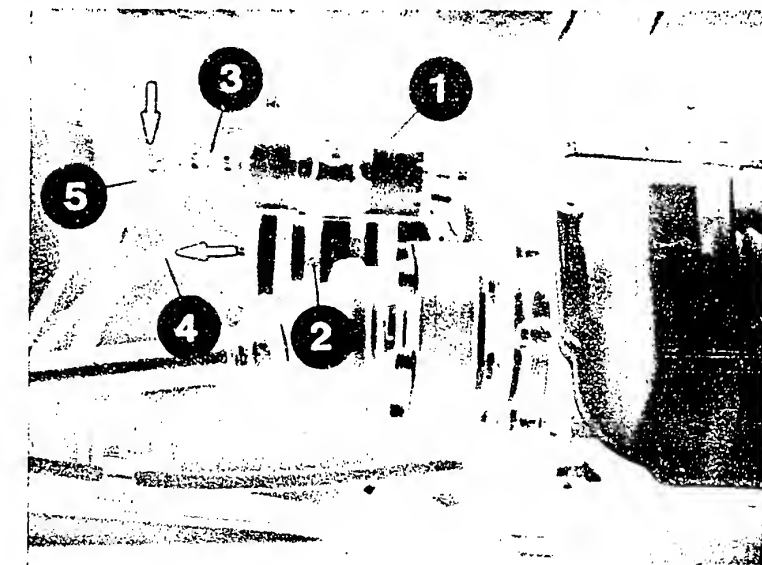


No max. engine power and/or max. velocity (continued)

yes

Trouble-shooting:

- Fuel filter is clogged: take it out and replace it.
- Is the voltage at the fuel pump plugs min. 12 V with the engine running? If not, clean the contacts. Eliminate any poor ground connection. Take out and replace the leads.
- Check the pre-supply pump. Check by listening: Disconnect the connecting plug at the electric fuel pump. Build up the fuel pressure: on the universal test adapter, set the program switch "V" in setting 17. Switch the ignition on and press button T3. The pre-supply pump must run. If not, check the connecting leads and if need be, take out and replace the pre-supply pump.
- The fuel pressure regulator is defective: take it out and replace it.
The fuel pressure regulator is fastened to the fuel distribution pipe using two fastening screws and across an O-ring. After the pressure regulator is taken out, the O-ring and the flat ring must be taken out and replaced. (Use set of parts 1 287 010 704).
- The fuel pump output is too low: take out and replace the fuel pump.
- Is the filter in the tank clogged? Is there corrosion in the tank?



- 1 = Pressure regulator
- 2 = Air hose to intake manifold
- 3 = Fuel-return hose
- 4 = Fuel-line-pressure damper

- 1 = Electric fuel pump
 - 2 = Fuel filter
 - 3 = Fuel intake line
 - 4 = Fuel delivery line
 - 5 = Fuel spinner
- Arrow = Direction of flow



Continued on M13/M14

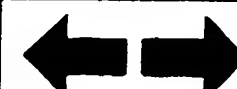
M11

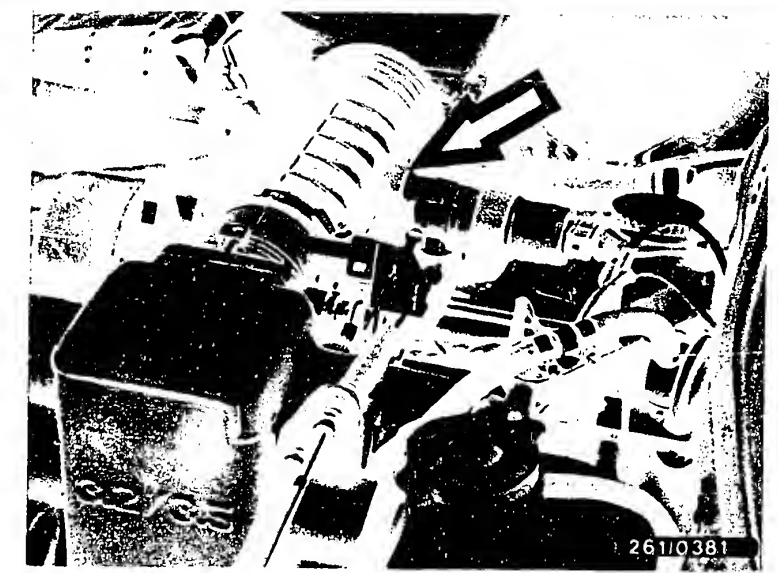
No max. engine power
BMW



M12

No max. engine power
BMW





Arrow = Disconnect hose here for leak test.

No max. engine power and/or max. velocity (continued)

yes

Are all the hose lines and electrical lead connections put on correctly? Visual inspection. Has the intake system been checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws. Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

yes

Checking the customer complaint
"No max. engine power"
has been completed.
Has the customer complaint been corrected?

no

Additional possible defects

- The customer complaint has been incorrectly identified. (See Coordinates C3 ... C10.) If the defect has not been identified using the "Targeted Trouble-Shooting" see "Detailed Trouble-Shooting" (Coordinates C3/C4).
- Engine is not O.K. mechanically. (Compression, valve setting, valve timing, wear on camshaft).

CO-LEVEL AT IDLE TOO LOW OR TOO HIGH

Trouble-shooting program according to customer complaint

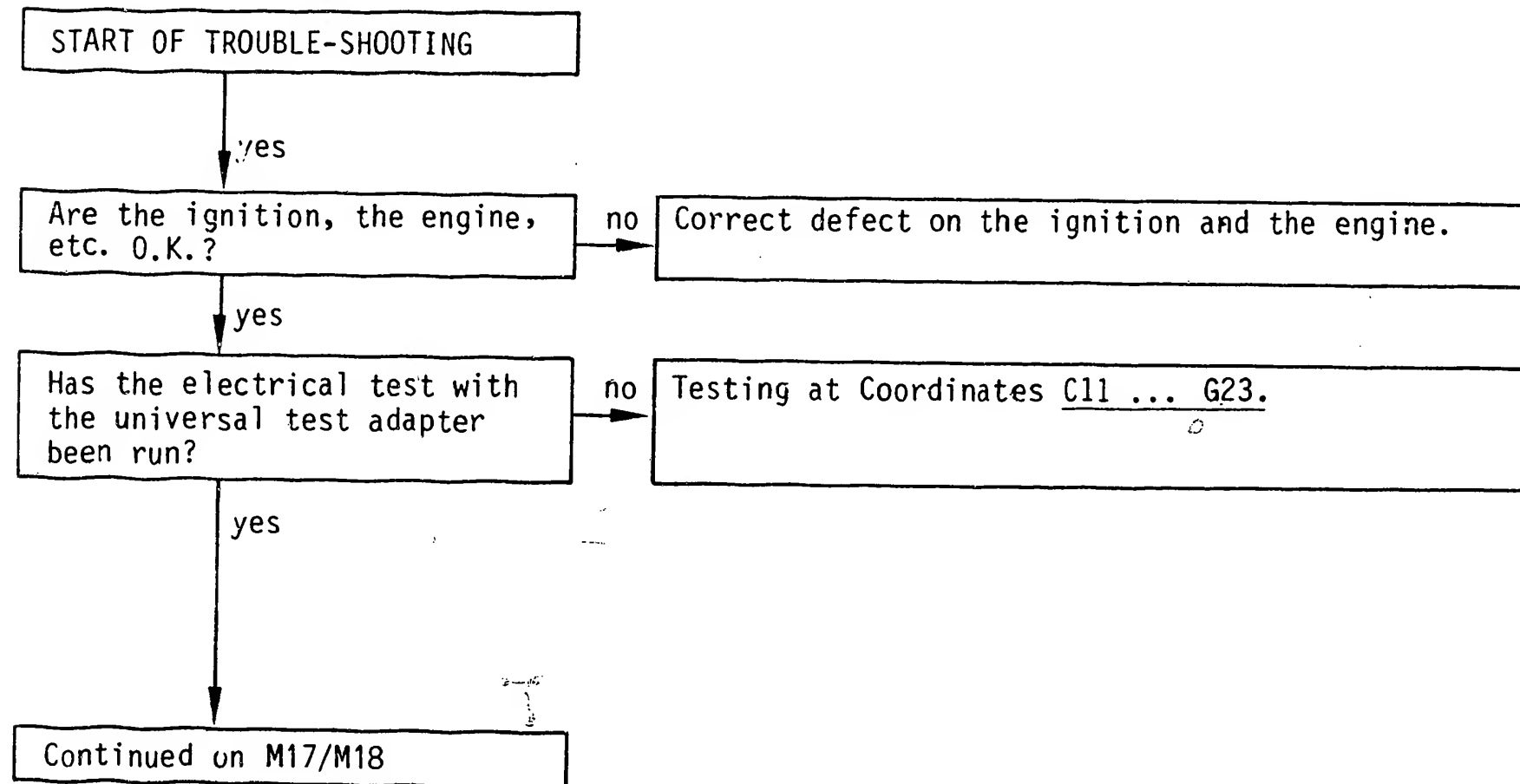
How to use the program

Testing is organized into 3 columns of boxes:

- In the column at the left are the questions for the tests being run.
- In the column in the center the component tests and settings are described.
- The column at the right shows the figures belonging to the text and the legend for the figures.

If it is possible to answer the questions clearly with "yes" even without testing, proceed to the next question below.

On the other hand, if the answer to the question is "no", and a defect is suspected, you must switch to the center column of boxes and carry through the tests indicated there. At the end of the test, the trouble-shooting is continued at that point at which the shift was made previously.



M15

CO-adjustment

BMW



M16

CO-adjustment

BMW



CO-level at idle too low or too high (continued)

yes

Check the secondary pattern for all cylinders. Is the secondary pattern O.K.?

no

Check the ignition coil and the high voltage portion: is the distributor cap covered with oil on the outside and inside? (Unscrew the distributor rotor and check the camshaft seal)

Notes:

Distributor cap is fastened with 3 screws. To remove the distributor cap the cover of the radiator must be removed. When putting the ignition leads on, watch the cylinder numbers! Do not forget the cover and shielding cap! Check the primary ignition coil for continuity (approx. 0Ω). Secondary coil resistance: 5 to 7.2 k Ω . Check the interference suppression resistors, the ignition leads, and the spark plugs.

Interference-suppression resistance in

Ignition distributor rotor:	1 k Ω
Ignition distributor housings:	each 1 k Ω
Spark-plug connectors:	each 5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

yes

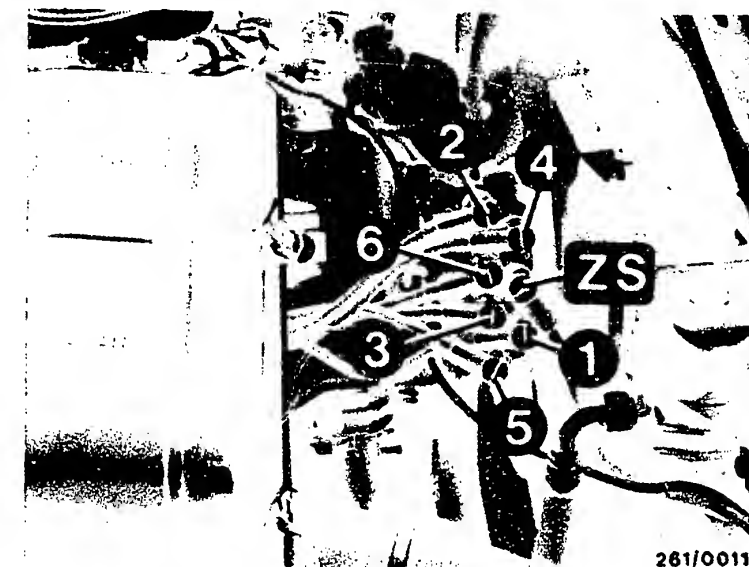
Is the air-flow sensor O.K.?

no

Testing: Open the air-flow sensor flap by hand. It must be possible to open the sensor flap with uniform ease as far as the stop, and the flap must close again on its own as far as the stop. The air-flow sensor flap must not stick when opening. Watch for signs of grinding. If the air-flow sensor is severely fouled inside, clean it, and rub it out with a lint-free cloth. If there are signs of grinding present, the air-flow sensor must be taken out and replaced.

yes

Continued on M19/M20



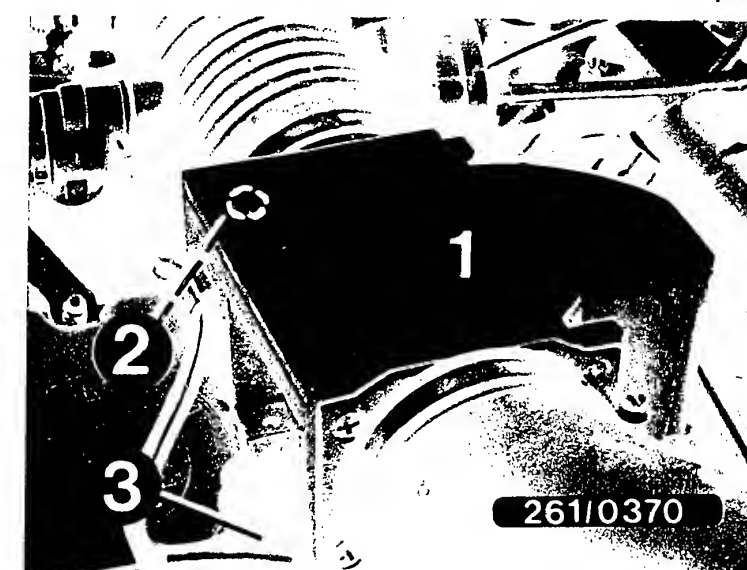
261/0011

High voltage distributor

1 - 6 = Cylinder numbers

ZS = High voltage lead to the ignition coil

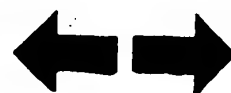
- 1 = Air-flow sensor with NTC I
- 2 = Idle-mixture-adjusting screw
- 3 = Air-flow sensor plug



261/0370

M17

CO-adjustment
BMW



M18

CO-adjustment
BMW



CO-level at idle too low or too high (continued)

yes

Is the start valve O.K.?
(Test for leaks)

no

Check the start valve for leaks:

1. In the engine

Clamp off the fuel delivery line at the start valve. If the engine then runs smooth, take out and replace the start valve.

2. Taken out of the engine

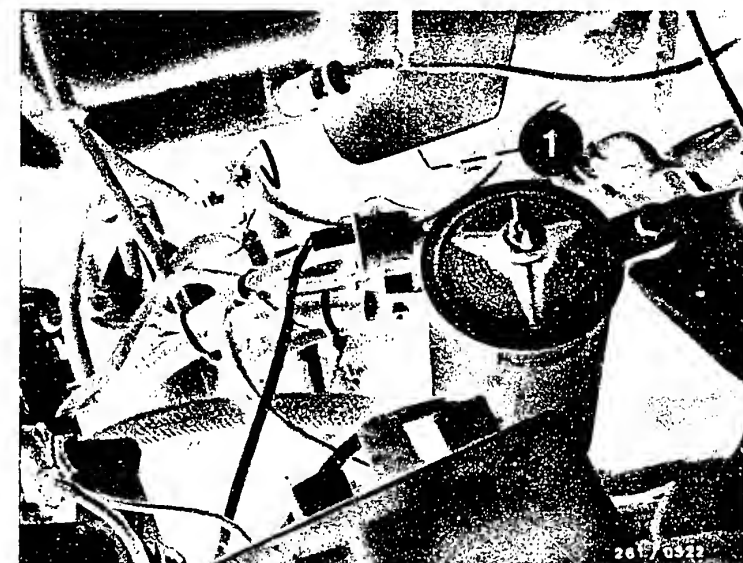
Take out the start valve. (Caution: fire hazard!) The fuel and the electrical lines remain connected. (Place a catch basin under the start valve.)

Build up the fuel pressure: on the universal test adapter, set the program switch "V" at setting 17. Switch ignition on, and press button T3.

Test specification: the formation of max. 1 drop is permissible at the opening of the valve within one minute.

yes

Continued on M21/M22



1 = Start valve (below on intake manifold)

M19

CO-adjustment

BMW

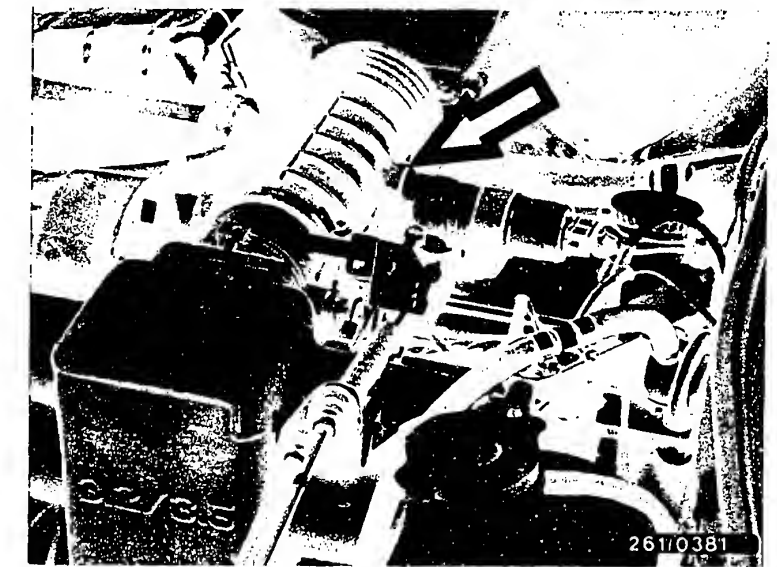


M20

CO-adjustment

BMW





Arrow = Disconnect hose here for leak test.

CO-level at idle too low or too high (continued)

yes

Are all the hose lines and electrical lead connections put on correctly? Visual inspection. Has the intake system been checked for leaks?

no

Check that the hoses on the air intake system and the fuel line system are put on correctly, without kinking or damage. If need be, take out and replace the hoses. Eliminate leaks by using new gaskets or by tightening the connecting screws.
Testing for leaks: Seal off the exhaust pipe and the air inlet point on the air filter. Seal off hose opening to idle actuator and blow air (approx. 0.3 gauge pressure) into intake manifold with a compressed-air gun. Throttle valve should be fully open. Brush or spray all joints with soapy water or leak-detector spray. Bubbling or foaming indicates leakage. Check electrical plug connections for loose contacts.

yes

Continued on M23/M24

M21

CO-adjustment
BMW



M22

CO-adjustment
BMW



CO-level at idle too low or too high (continued)

yes

CO value OK?
Test specification:
0.2...1.2 vol. % CO
Measure before cat. converter,
plug connection from lambda
sensor separated.
Engine at operating temperature
and all electric loads switched
off.
Idle speed
750...850 min⁻¹

no

- For exhaust-gas adjustment remove vent plugs in air-flow sensor with special tool and adjust mixture-adjusting screw.
Right turn: CO value rises.
Left turn: CO value falls.
Subsequently use new vent plugs.
- If CO not adjustable and mixture too lean:
Repeat leakage test of induction system.
Mixture too rich:
Repeat measurement and adjustment with crankshaft housing vent hose disconnected, otherwise check air-flow sensor

yes

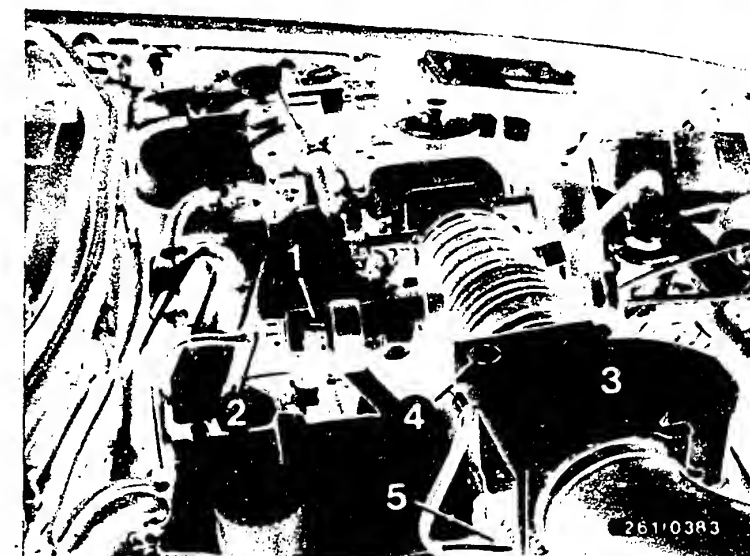
Testing completed for customer complaint

"CO level at idle too low
or too high"

no

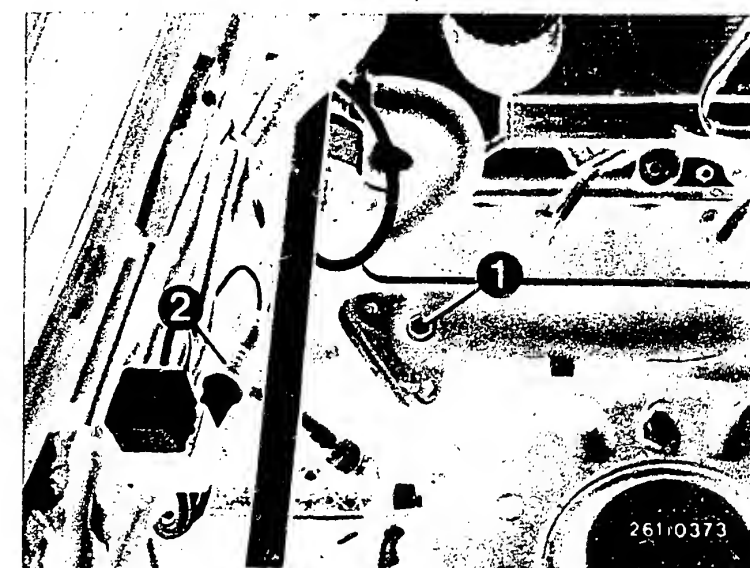
Further possibilities

- Customer complaint incorrectly diagnosed (see coordinates C3...C10). If the fault was not detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not in good mechanical order (compression, valve setting, valve timing, worn camshaft).



- 1 = Idle actuator
- 2 = Actuator plug
- 3 = Air-flow sensor with NTC 1
- 4 = Idle-mixture-adjusting screw
- 5 = Air-flow sensor plug

- 1 = CO connection before catalytic converter (cyl. 4, 5, 6)
- 2 = Plug connection from lambda sensor



M23

CO-adjustment

BMW



M24

CO-adjustment

BMW



After-sales Service

Technical Bulletin

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13...39

VDT-I-261/102 En

6.1983

PARTS SET FOR SOLENOID-OPERATED INJECTION VALVES

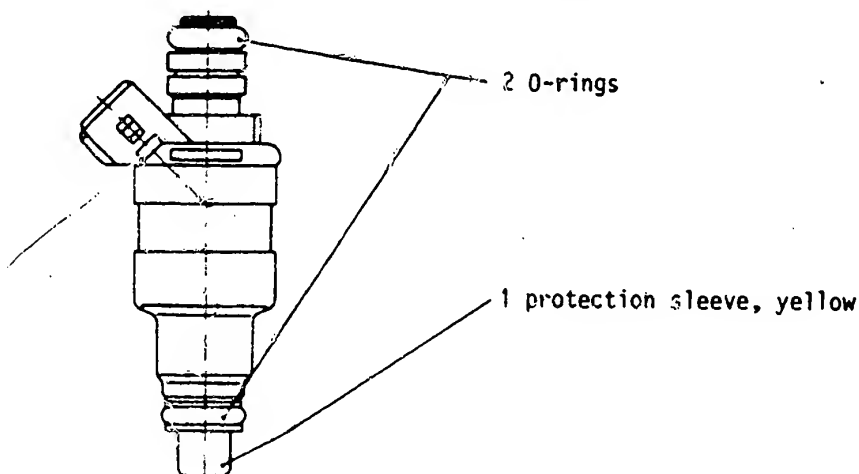
Supersedes 8.1982 edition

0 280 150 2..

AND PRESSURE REGULATORS 0 280 160 2..

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve:



Contents for pressure regulator:

1 O-ring

1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 764 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH

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BMW



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PLUG CONNECTORS FOR JETRONIC COMPONENTS Parts sets

VDI-I-280/111 En

11.1984

(supersedes edition 11.1982)

Parts sets are available for replacement of Jetronic plug connectors. These consist of:

- Plug connector housing
- Protective cap (rubber sleeve)
- Contact springs

These parts are listed on microfiche EE...*.

* see microfiche EE00 under 0 280 ..

- Plug, black, 2-pin,
parts set 1 287 013 002 cable connector in conjunction with socket, 2-pin
- Socket, black, 2-pin,
parts set 1 287 013 001 for e.g.

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..

- Socket, grey, 2-pin
parts set 1 287 013 003 for:

Solenoid-operated injection valve	0 280 150 ..
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- Socket, black, 3-pin,
parts set 1 237 000 039 for:
Throttle-valve switch 0 280 120 ..
- Socket, black, 5-pin,
parts set 1 287 013 006 for:
Air-flow sensor 0 280 20. ..
(LE version)
- Socket, black, 6-pin,
parts set 1 287 013 004 for:
Air-flow sensor 0 280 ..
- Socket, black, 7-pin,
parts set 1 287 013 005 for:
Air-flow sensor 0 280 20. ...
Air-mass sensor 0 280 211 ..
- Wiring-harness plug connector, black, 25-pin
parts set 1 287 013 009 for:
Control unit 0 280 0..
- Wiring-harness plug connector, black, 35-pin,
parts set 1 287 013 008 for:
Control unit 0 280 0..

The contact springs (minitimers) are also available separately under part no. 1 284 477 026.

The plug-connector housings are only available in the stated colours.

Responsible:

Robert Bosch GmbH

Division KH

Technical After-Sales Service (KH/VKD 2)

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T A B L E O F C O N T E N T S

When direct trouble-shooting a specific Motronic component, it is absolutely essential to look up the component involved under the corresponding customer complaint.

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